TECHNICAL MEMORANDUMS

NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS.

No. 301

LIGHT AIRPLANES

OF

FRANCE, GERMANY, ITALY, BELGIUM, HOLLAND, CZECHOSLOVAKIA AND LITHUANIA.

Compiled by the National Advisory Committee for Aeronautics.

February, 1925.

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In the presentation of data regarding light airplanes of these countries, it will not be possible to make comparisons as completely as given in preceding Technical Memorandums, owing to lack of information and a more complete or extensive program governing the contest or test flight. The characteristics or qualifications, however, as available in published accounts, are given individually with the structural description and will be found to represent quite thoroughly the performance or efficiency of the airplane.

Unfavorable weather interfered seriously in the "Tour of France" and the "Rhön" contest and prevented, no doubt, a more successful participation on the part of airplanes which had previously displayed excellent qualifications both in performance and structural design.

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* Compiled by the National Advisory Committee for Aeronautics.
See Technical Memorandum No. 289: Two-Seat Light Airplanes which Participated in Contest Held at Lympne, England, Week of September 29 to October 4, 1924; and No. 297: Royal Aero Club Light Aeroplane Competition.

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TOUR OF FRANCE *

The "Tour of France" or cross-country race was organized by the Association Aerienne Francaise, for the purpose of developing light airplanes. The tour began at Buc near Paris with obligatory stops first at Clermont-Ferrand, a distance of 340 km (211 mi.), then at Valence, 169 km (105 mi.), then Nimes, 128 km (80 mi.), Toulouse, 241 km (150 mi.), Angouleme, 253 km (157 mi.), Pornichet, 261 km (162 mi.), Tours, 228 km (142 mi.), and back to Buc, 137 km (116 mi.), a total distance of 1807 km (1123 mi.). Two days were allowed between stops, the first for actual flying and the second for repairs and rest.

The contest began the latter part of last July, with about fifteen entries: nine from France, and two each from Belgium, Holland and Czecho-Slovakia. Of this number but three passed the elimination test, which consisted of a flight of 50 km (31 mi.) in the vicinity of the Buc airport followed by a climb to 2000 m (6560 ft.), the gasoline and oil consumption not to exceed 8 kg (17.6 lb.) for single seaters and 12 kg (26.5 lb.) for two seaters.

Two Dewoitine monoplanes passed this test successfully but in having failed to receive a license from the Air Navigation Service, could not take part in the race.

The weather was very unfavorable the greater part of the time and undoubtedly interfered with the qualification of some excellent designs.

* "Aviation," Sept. 15, 1924.

Of the French airplanes the "Beaujard-Viratelle" did not arrive, while the "Ligreau" was not ready in time. One "Dewoitine" crashed when taking off from Villacoublay and one of the "Farmans" did not fly in the elimination test on account of the weather.

The Holland airplanes were eliminated, one arriving too late and the other failing to obtain a license from Holland authorities.

Both Belgium airplanes failed to arrive in time, the "V" Simonet" on account of the weather and the "Demonty-Poncelet" in having structural or engine trouble.

The two "Avias BH-16" representing Czecho-Slovakia, did not get through the elimination tests on account of engine trouble.

The three airplanes qualifying for the race are the "Carmier," "Bleriot" and "Farman."

In the race the "Bleriot" failed, in being unable to penetrate the fog. The "Carmier" was forced down at Etampes on account of the fog, and the "Farman" at the same place, on account of a leak in the oil connections. Both airplanes, however, were able to proceed the same day to the first official stop. In the race to the second stop, involving flight over mountains, the "Carmier" failed to get through the fog at an altitude of 520 m (1700 feet) and was forced to return to the airport where a succession of accidents prevented further participation in the contest. The "Farman" was therefore left alone to cover the rest of the Tour.

The following table* gives information regarding engines used with dimensions and areas of all airplanes entered for the tour.

Name	Type	Engine	Span m ft.	Length m ft.	Wing area m^2 sq.ft	Height m ft.	Dead load kg lb.	Full load kg lb.
Holland H-2 **	M	Anzani 22/25 HP.	7.69 25.23	4.82 15.81	10.2 109.8	-	170 375	295 650
" H-1	B	" 30/35 "	7.70 25.26	5.68 18.64	14.0 150.7	-	220 485	320 705
Farman	M	Salmson 15 HP.	7.00 22.97	5.50 18.04	10.0 107.6	2.00 6.56	100 220	-
"	M	Anzani 30 "	7.00 22.97	5.50 18.04	10.0 107.6	2.00 6.56	120 265	235 518
Avia BH-16	M	Blackburne 16 HP.	9.50 31.17	5.06 16.60	10.6 114.1	2.16 7.09	127 280	235 518
" "	M	Vaslin 16/20 HP.	9.50 31.17	5.06 16.60	10.6 114.1	2.16 7.09	130 287	230 507
Carmier	M	Anzani 30 HP.	8.00 26.25	4.50 14.76	9.75 104.9	1.72 5.64	200 441	328 723
Demonty-Poncelet	M	Gregoire 40 HP.	12.00 39.36	6.50 21.33	20.0 215.3	-	330 728	520 1146
Simonet	M	Sergant 16 HP.	11.20 36.75	6.60 21.65	20.0 215.3	-	-	-
Dewoitine	M	Vaslin 35 HP.	13.00 42.65	5.60 18.37	16.5 177.6	-	-	-
"	M	" 16/20 HP.	13.00 42.65	5.60 18.37	16.5 177.6	-	250 551	-
"	M	" 20 HP.	13.00 42.65	5.60 18.37	16.5 177.6	-	250 551	-
Bleriot A.N.E.C.	M	Blackburne 16 HP.	9.75 31.99	4.75 15.58	13.47 145	-	131.5 290	213 470
Beaujard-Viratelle	M	Sergant HP.	-	-	-	-	-	-
Ligreau	M	Ligreau 8/10 HP.	-	-	-	-	-	-

* From "L'Aeronautique," No. 63, August, 1924.

** Dimensions and areas differ from those taken from Manufacturers circular.

LIGHT AIRPLANES OF FRANCE

"Farman" Monoplane.*

The "Farman" light airplane (one-seat monoplane), the winner of the "Tour of France" contest, completed the flight in fifteen days with an actual flying time of 20 hrs. 41 min. 27 sec., and an average speed of 87.55 km (54.4 mi.) per hour.

A speed of 69.2 miles per hour was attained between the first and second official stops.

The scarcity of information regarding the structural design of this efficient airplane is very much regretted. The outline drawings are all that is available at this time.

Specifications:

Full load	235 kg	(518 lb.)
Dead "	120 "	(265 ")
Wing loading	23.5 kg/m²	(4.81 lb./sq.ft.)
Power "	7.83 kg/HP.	(17.26 lb./HP.)

Fig. 1 contains the outline drawings with dimensions, areas and engine data.

* From "Les Ailes," Aug. 14, 1924; "L'Aeronautique," Aug., 1924; and "L'Aerophile," Aug. 15, 1924.

"Carmier" Monoplane.*

The "Carmier" light airplane (one-seat parasol monoplane) designed by the Carmier Bros. and Mr. Dupuy, is one of the most original airplanes participating in the "Tour." Unfortunately it was unable to complete the tour on account of damage to the landing gear.

Structurally it contains some very interesting features.

The fuselage consists of four wooden longerons around which is constructed the light formers of the streamlined frame. All points of attachment are joined in such a way as to provide a certain amount of play which gives the structure exceptional flexibility.

The pilot's seat is under the rear half of the wing, the trailing portion of which is cut away to afford a better view.

A stabilizer is not used, the elevator being so mounted as to serve in this capacity. The elevator framework is of metal.

The framework of the rudder is also of metal.

Metal tubing is used in the landing gear structure with sandow cords as shock absorbers.

The wing is semi-cantilever with a Dewoitine wing section and is attached to the fuselage by means of a cabane. A pair of struts of steel tubing and streamlined join the wing spars on each side to the fuselage longerons. The spars are of spruce with plywood ribs.

Wing length ailerons are used and are equipped with mechanism by which they can be operated simultaneously or differentially and also in conjunction with the elevators, the latter feature affect-

* From "L'Aeronautique," August, 1924; "L'Aerophile," Aug. 15, 1924.

ing the operation of two pairs of ailerons in tandem such as used on the Peyret glider. The action of the elevator, as such, is temporarily retained.

Specifications:

Dead load	200 kg (441 lb.)
Full "	328 kg (723 lb.)
Wing loading	33.6 kg/m^2 (6.88 lb./sq.ft.)
Power "	10.9 kg/HP. (24 lb./HP.)

Other characteristics with HP. of engine and the outline drawings are given in Fig. 2.

LIGHT AIRPLANES OF HOLLAND

The "Pander H-2" Monoplane.*

The "H-2" light airplane (two-seat monoplane) entered in the "Tour of France" by the Vliegtuig-Industrie of Holland is also suited for use in the training of pilots. The wing is the cantilever internally braced type with rounded tips.

The fuselage is somewhat elliptical in cross-section with a streamlined head rest.

A very strong landing gear is provided in the double-diagonal struts, which are so arranged that the usual horizontal axle is not required. This feature also makes landing in tall grass comparatively safe.

The structural factor of safety is 7.5 throughout. The take-off and landing are accomplished in a run of 50 m (164 ft.) and the speed can be varied between 40 (25) and 120 km (75 mi.) per hour.

Its characteristics are:

Full load	295 kg	(650 lb.)	
Dead "	170 "	(375 ")	
**Fuel "	50 "	(110 ")	
Wing loading	28.9 kg/m²	(5.92 lb./sq.ft.)	
Power "	11.8 kg/HP.	(26.01 lb./HP.)	

** Sufficient for an eight-hour flight.

Fig. 3 gives outline drawings, dimensions, areas and engine data as taken from the Manufacturers circular.

* From "L'Aeronautique," Aug., 1924, and Manufacturers circular.

"H-1" Biplane.*

The "H-1" light airplane (two-seat biplane) entered in the "Tour of France" contest by the Vliegtuig-Industrie of Holland was designed for use as a training airplane and being strongly built, is also very suitable for sport flying.

The wings are of medium thickness, with a greater span for the lower wing.

The tanks carry 38 liters (10 gallons) of gasoline and 9.5 liters (2.5 gallons) of oil, sufficient for a three-hour flight.

Its characteristics are:

Full load 325 kg (705 lb.)

Dead " 220 " (485 lb.)

Wing loading 30.3 kg/m^2 (6.21 lb./sq.ft.)

Power " 10 kg/HP. (24.24 lb./HP.)

Fig. 4 contains outline drawings with a sketch taken from a half-tone cut and engine data.

*From "L'Aeronautique," August, 1924.

"12-A" Monoplane.**

The "12-A" light airplane (one-seat high-wing monoplane) built by the Vliegtuig-Industrie of Holland, made a non-stop flight, in bad weather, from Rotterdam-Brussels-Paris and back to Rotterdam. The French have flown it in a series of tests to determine its value from a military point of view. It did not take part in the "Tour of France"

** From "Flugsport," April 15, 1924.

The fuselage in cross-section has the shape of an inverted drop of water with the point resting upon the landing gear axle. The latter is also braced by inverted V struts extending from the point of junction of the wings to the fuselage.

The characteristics are:

Full load	255 kg	(562 lb.)
Dead "	152 "	(335 ")
*Fuel "	28 "	(62 ")
Wing loading	21.25 kg/m²	(4.35 lb./sq.ft.)
Power "	8.5 kg/HP.	(18.75 lb./HP.)
Maximum speed	145 km	(91 mi.) per hour.
Minimum "	48 "	(30 ") " "

*Sufficient for 5.5 hours' flying.

Fig. 5 contains outline drawings, dimensions, areas and engine data.

LIGHT AIRPLANE OF BELGIUM

"Demonty-Poncelet" Monoplane.*

The "Demonty-Poncelet" light airplane (two-seat high-wing monoplane) is the semi-cantilever wing type arranged for folding. It is referred to by the designer as a small "air limousine" having accommodations for two occupants seated abreast in a closed cabin. In the side-elevational view the fuselage has a decided drop under the wings giving a shape very similar to that of a pigeon's body.

The fuselage is constructed of wood throughout.

The wings are attached to the top of the fuselage at two points, the attachment at the rear spar being a universal joint while at the front spar two bolts are used. An inverted V strut joins the wing spars on each side to a reinforced frame at the bottom of the fuselage. The wings can be easily removed.

A Lamblin radiator is used and is installed on top of the fuselage.

There is no stabilizer, the elevator being of the balanced type and oscillating, serves in this capacity.

Specifications:

Full load 520 kg (1146 lb.)

Dead " 330 " (728 ")

Wing loading 26 kg/m² (5.33 lb./sq.ft.)

Power " 13 lb./HP. (28.66 lb./HP.)

Fig. 6 contains the outline drawings, dimensions, areas and engine data.

* From "L'Aeronautique," August, 1924.

LIGHT AIRPLANES OF CZECHOSLOVAKIA

"Avia BH-16" Monoplane.*

Two "BH-16" light airplanes (one-seat low-wing monoplane) constructed from designs of Benes and Hajn, were entered in the "Tour of France" contest by the Czechoslovak firm of Avia-Milos Bondy.

The wings are partially covered with plywood which is varnished and polished.

The landing gear is made of steel tubing, with rubber shock absorbers and is well adapted to landing in cross-country flying.

The characteristics are:

Full load 235 kg (518 lb.)
Dead " 127 " (280 ")
Wing loading 22.2 kg/m^2 (4.55 lb./sq.ft.)
Power " 13 kg/HP. (28.6 lb./HP.)

Fig. 7 contains the outline drawings, dimensions, areas and engine data.

* From "L'Aeronautique," August, 1924.

RHÖN CONTEST IN GERMANY*

The following rules and regulations were adopted by the various committees and organizations to govern the 1924 Rhön contest for light airplanes.

Admission Test.

For Airplanes:

Airplanes must make trial flights of at least 10 minutes duration. The proof of this flight to be presented in the form of a certificate signed by an authorized representative of the directors of the contest.

For Engines without Weight Limit:

Piston displacement not to exceed 750 cm^3 (45.77 cu.in.) for one-seat airplanes, and 1000 cm^3 (61.02 cu.in.) for two-seat airplanes.

For Engines with Weight Limit:

Weight not to exceed 30 kg (66.14 lb.) for one-seat airplanes, and 40 kg (88.2 lb.) for two-seat airplanes. The engine weight to include the weight of the carbureter, magneto, driving gear, empty radiator, empty oil tank and propeller.

Endurance Test.

A prize shall be awarded to the contestant who remains longest in the air, the fuel consumption not to exceed 2 liters (.53 gallon). While on this flight a distance of at least 5 km (3.1 mi.) must be flown from the starting point and upon returning the contestant must fly across a 300 m (984 ft.) line drawn through the starting point.

* From "Zeitschrift fur Flugtechnik und Motorluftschiffahrt," June 26, 1924.

Goal Flight.

A prize shall be awarded to the contestant who flies in the shortest time and with the least fuel consumption from the Wasserkuppe hills to a place designated by the directors of the contest, land, and make a return flight. The rating shall be determined by the formula $G = t\sqrt{f}$ in which t represents the total time and f the quantity (in liters) of fuel consumed.

Altitude

A prize shall be awarded to the contestant who attains the greatest altitude above the summit of the Wasserkuppe hills with 10 cm^3 (.61 cu.in.) of fuel for each kilogram of combined weight of pilot and useful load.

Contest

The contest was scheduled to take place in August, 1924, from the 10th to the 28th, inclusive. Unfortunately, the weather at that time was extremely unfavorable - rain, fog, low clouds or stormy winds occurring almost daily - and as a result the contest was greatly handicapped. In the race to Kissingen and back, August 24, three airplanes only, the "Kalibri" U7, "Windhund" and "Habicht," started and succeeded in reaching Kissengen. In the return the "Windhund" was unable to get off the sodden ground and the "Habricht" was detained on account of lubrication trouble. The "Kalibri" alone succeeded in making the return trip and in so doing won the first prize. This airplane also

won first prize in the altitude contest. The second prize was won by the "Roter Vogel," a glider equipped with a Douglas engine. A description of these airplanes with line drawings is given in this Memorandum.

A brief reference will be made to other light airplanes, the specifications of which are given in the accompanying table. It is stated in one publication that about 30 light airplanes were entered for the contest but as will be seen in the above-mentioned table, about six only were able to fly under the weather conditions.

In the "Windhund" (M.M.1) all dimensions, as compared to the known "Strolch," were diminished as much as possible. Its wings were strongly reinforced. A reduction gear drive was used.

The "Habicht" is a high-wing parasol monoplane with a slight sweep back. A single spar is used in the wing which is connected to the rectangular fuselage by strong struts.

The "Betty" and "Buby" are monoplanes with high wings constructed in three parts and can be folded back for transportation. One spar is used and the landing gear is small bringing the fuselage very near the ground. There is no stabilizer and the fin and rudder are large. All surfaces are well streamlined. A reduction chain drive is used.

The "Knorke" also had a deeply bulging fuselage and a low landing gear. The tail unit consists of a divided elevator without a stabilizer and a high fin and high rudder.

After a short preliminary trial flight, the pilot flew over the

Pelzner slope at which point he pitched the airplane too steeply, causing it to descend rapidly and before he could regain control, it crashed.

List of the more important light airplanes in the 1924 Rhön Contest.

Owner	Name	Span m ft.	Mean chord m ft.	Aspect ratio	Wing area m^2 sq.ft.	Dead load kg lb.	Loading kg/m^2 lb./sq.ft
"Udet Flugzeugbau" Munchen	U 7 Kolibri	10 32.81	1.25 4.1	8	12.5 134.5	165 364	21 4.3
"Arbeitsgem Unterfranken" Wurzburg	Udet Kolibri	10 32.81	1.25 4.1	8	12.5 134.5	-	-
"Rhön Mobelwerke" Fulda (Martens)	Max	14 45.93	1 3.28	14	14 150.7	-	-
"Rhön Mobelwerke" Fulda (Martens)	Windhund (M.M.1.)	8.5 27.9	0.94 3.08	9	8 86.1	-	-
"Baumer Aero" Hamburg	Roter Vogel	10 32.81	1.36 4.46	7.4	13.6 146.4	180 397	22 4.5
"Blume-Hentzen"	Habicht	12 39.37	0.9 2.95	13.3	10.8 116.3	190 419	27.3 5.6
"Arbeitsgem" Wurzburg (Messer-schmitt)	Betty S 16	14.4 47.24	0.97 3.18	15	14 150.7	218 481	-
"Arbeitsgem" Wurzburg (Messer-schmitt)	Buby S 15	14.4 47.24	0.97 3.18	15	14 150.7	-	-
"Sperber Segelflug-verein" Berlin	Knorke	12 39.37	1.2 3.94	10	14.4 155.0	-	-

Table (Cont.)

Owner	Engine	R.P.M.	HP.	Weight kg lb.	Piston dis-placement cm³ cu.in.	Prop. dia. m ft.	Remarks
"Udet Flugzeug-bau" Munchen	Douglas	3500	21	34 75.0	750 45.77	-	Winner 1st prize Kissengen & altitude contest. Endurance record.
"Arbeitsgem Unterfranken"	Douglas	3500	14	32 70.5	500 30.5	-	Destroyed by fire in tent.
"Rhön Mobel-werke" Fulda (Martens)	Ilo	2500	4.5	20 44.1	296 18.06	1.05 3.44	-
"Rhön Mobel-werke" Fulda (Martens)	Douglas	3600	18	40 88.2	596 36.37	-	Flew to Kis-sengen.
"Baumer Aero" Hamburg	Douglas	4000	14	33 72.8	350 21.36	1.25 4.10	-
"Blume Hentzen"	Siemens	-	-	-	740 45.77	1.80 5.91	Flew to Kis-sengen.
"Arbeitsgem" Wurzburg (Mes-serschmitt)	Douglas	3500	21	34 75	750 45.77	1.60 5.25	Propeller bearing block broken.
"Arbeitsgem" Wurzburg (Mes-serschmitt)	Douglas	3500	14	32 70.5	500 30.5	1.40 4.59	-
"Sperber Segel-flugverein" Berlin	Prussing Stenersen	1800	19		588 35.88	1.35 4.43	Crashed

"Kalibri U-7" Monoplane.*

The "Kalibri U-7" light airplane (one-seat parasol monoplane), a product of the "Udet Flugzeugbau" is an excellent piece of work. It was designed for use by the private individual as a sport or training airplane and being very easily controlled and having a low landing speed, can be operated from a small field. It was the most successful participant in the Rhön contest.

The fuselage is of rectangular cross-section and is made of plywood. Access to the cockpit is facilitated by a side door which although interrupting the upper longeron leaves sufficient room below for the required bracing. Another door gives access to the baggage compartment.

The wings are cantilever with two spars and a plywood-covered leading edge, and are so constructed that they can be joined by telescoping at the middle, providing a rigid continuous wing. This structure is securely attached to the fuselage by means of streamlined struts with the wings held well above the fuselage.

An important feature in the structure of this airplane is the ease by which assembly and disassembly are accomplished. The wings, stabilizer, elevator, fin and rudder are each readily attached or detached by the simple manipulation of a few self-locking bolts. The engine with the chain-reduction gear can be drawn from the end of the fuselage like a drawer, the gasoline, oil and ignition connections, of course having first been disconnected. The tanks are

* From "Flugsport," Sept. 15; "Deutsche Motor-Zeitschrift," Oct.; and "Zeitschrift fur Flugtechnik und Motorluftschiffahrt," Nov. 28, 1924.

removable by the simple loosening of two straps.

The engine bed in the nose of the fuselage is constructed of sheet and sectional duralumin and is carefully protected against gasoline leakage from the other part of the fuselage.

A similar Udet "Kolibri" was entered by the "Wurzburg Arbeitsgemeinschaft," the only difference being that it was equipped with 500 cm^3 engine. It did not take part in the contest, having been destroyed by fire while in its tent.

In the transportation of these airplanes the wings are laid upon the cabane struts and rudder post, and the tail skid is attached to the rear seat of a motorcycle.

Their characteristics are:

Full load	250 kg	(551 lb.)
Dead "	165 "	(364 ")
*Fuel "	25 "	(55 ")
Baggage load	5 "	(11 ")
Wing loading	21 kg/m^2	(4.30 lb./sq.ft.)
Power "	13.9 kg/HP.	(30.6 lb./HP.)
Weight of occupant	70 kg.	(154 lb.)
Fuel consumption	6 l.	(1.58 gal.) per hour.
Climb	1000 m	(3281 ft.) in 8 min.
Speed	120 km	(75 mi.) per hour.

* Sufficient for a 4-hour flight.

Fig. 8 contains dimensions, areas, engine data and outline drawings.

"Roter Vogel" Monoplane.*

The "Rotor Vogel" light airplane (one-seat high-wing monoplane) was originally designed as a glider and was converted into an airplane by the addition of an engine (smallest ever employed successfully in an airplane) and as such was exceptionally efficient.

The structure of the fuselage and wing is very similar to that of the "Pelican (H6)", both having been built by the Baumer Aero Company.

The wing is a full cantilever and is attached directly to the top of the fuselage, resembling in this respect the "Grief." The wing is very lightly built and has quite a large aspect ratio (7.4).

There is no stabilizer or fin.. The elevator and rudder can be easily removed and the controls are entirely enclosed within the fuselage.

The landing gear consists of two wheels and a straight axle, the latter passing through the bottom of the fuselage without bracing. The ball in the nose has been retained but the two which had been used as a landing gear have been replaced by wheels.

The engine is installed at the center of gravity of the airplane, as effected by the additional propeller and its operating mechanism, placing it immediately behind the pilot's seat.

The chain-driven propeller shaft crosses above the pilot's head to the propeller at which point the bearing is supported by light streamlined struts extended from the nose of the fuselage.

* From "Flugsport," Sept. 30, 1924 and "Zeitschrift für Flugtechnik und Motorluftschiffahrt," Nov. 28, 1924.

The propeller, in this position, is not affected by the retardation of the slipstream usually caused by the presence of the fuselage and is therefore more efficient. In previous flights, the longest of which lasted over two hours, the high speed attained, with so small an engine, was especially noteworthy, surpassing at times that of airplanes with engines twice as powerful. Its climbing ability with relation to its great weight per horsepower was also very satisfactory. In one flight, with a change in gear ratio resulting in an increase in engine speed, its climbing efficiency was nearly doubled. It is also very stable and although having no stabilizing surfaces, can fly with loose rudder and elevator.

The principal characterics are:

Full load 235 kg (518 lb.)
Dead " 180 " (397 ")
Wing loading 22 kg/m^2 (4.5 lb./sq.ft.)
Power " 29.4 kg/HP. (64.8 lb./HP.)

The fuel consumption was the least so far attained, due, of course, to the high speed and smallness of engine, which had a stroke volume of 350 cm^3 (21.4 cu.in.).

Minimum power required to maintain horizontal flight is 3.9 HP.

Gear drive ratio 16/34
Propeller pitch 1.075 m (3.526 ft.)

The outline drawings, dimensions, areas, and engine data are given in Fig. 9.

Immediately following will be found a description of four German two-seat light airplanes and one single seater which did not take part in the Rhön contest: The "Albatross L66," "Daimler L 15," "Caspar C 17," Udet and Aachen "KF."

"Albatross L 66" Monoplane.*

The "Albatross L 66" light airplane (two-seat parasol monoplane) can be employed either as a one- or two-seater and is so constructed that with the installation of dual control, it can be used as a school airplane. Its production cost is considered by the builders to be low while the strength and stability calculations conform to regulations now in force in Germany.

The fuselage is constructed of steel tubing with welded joints, braced by steel wires. Doped water-tight linen is used as a covering.

The usual control stick and rudder bar are employed.

All instruments used in the operation of the engine and airplane are within easy reach from both seats.

The fuel tank is located in the wing over the center of gravity and is rigidly attached to the cabane. In this position it provides a gravity feed. The tank holds 33 liters (8.7 gal.), enough for a three-hour flight with a wide-open throttle.

The wings are in two parts coupled to the cabane and braced by two oblique struts extended from the fuselage. The spars and ribs are wood and are covered with doped water-tight linen.

* From "Flugsport," June 14, 1924.

In order to make the airplane portable the wings and fuselage are so constructed that the former can be folded against the latter and clamped to the rudder, the ailerons having first been turned up. The folded airplane has a width of 1.2 m (3.9 ft.), a length of about 5.5 m (18 ft.) and a height of about 2.2 m (7.2 ft.).

The landing gear axle passes through the lower part of the fuselage and the wheels in themselves provide the required flexibility. This arrangement decreases the height of the fuselage above the ground and greatly increases safety in landing.

The characteristics are:

Full load 395 kg (871 lb.)
Dead " 220 " (485 ")
*Fuel " 25 " (55 ")
Wing loading 29.3 kg/m^2 (6.0 lb.)/sq.ft.)
Power " 11.3 kg/HP. (24.9 lb./HP.)
Speed about 100 km (62 mi.) per hour.
Climb 1000 m (328.1 ft.) in about 15 minutes
Flight duration 3 hours

* Sufficient for a three-hour flight with full throttle.

The outline drawings, dimensions, areas and engine data are given in Fig. 10.

"Daimler L 15" Monoplane.*

The "Daimler L 15" light airplane (two-seat high-wing monoplane) contains the reconditioned wings and fuselage of the low-powered monoplane glider designed by Herr Klemm and constructed at the Daimler Carriage Works in 1919. In 1922 it was converted into a glider by the removal of the engine and experiments showed it to be very efficient aerodynamically and possessing ample controllability. It was then equipped with another, more powerful, engine and designated the L 15 light airplane. As will be seen from the outline drawings, it is cantilever with a semi-thick wing tapering in both chord and ordinate toward the tips. The two spars are of new design in cross-section which it is claimed prevents buckling. The wing is in three sections with the tip lengths half the central length in span and is without dihedral or sweep back. The sections are joined by quick release devices. Ordinary ailerons are used and are hinged to the rear spar.

The fuselage is of the usual structure, consisting of four longerons with wire bracing and formers. In section the main structure is rectangular, but fairings are added to top and bottom to give better streamlining. The covering is fabric, doped in the usual way. The front end of the structure is detachable near the leading edge of the wing at which point two transverse members are adjacent and are joined by a simple union requiring no adjustment or special

* From "Das Leichtflugzeug für Sport und Reise" by Werner v. Langsdorff, 1924; "Flight," May 8, 1924.

tools. All separable parts are joined by slender safety bolts and a disassembly is easily accomplished.

In the control mechanism the usual stick and rudder bar are used with provisions for dual control if needed and the cables are almost entirely within the fuselage and wings.

The pilot occupies the front seat situated between the spars. With a passenger in the back seat the counter balancing of the engine weight seems to be good although it appears likely that with this arrangement the center of gravity might be somewhat aft.

The landing gear is equipped with wheels having three-ply wood disk sides and ash rims but without rubber tires. Loads up to 600 kg (1323 lb.) were withstood by one wheel under test without breaking, although it weighed but 1.2 kg (2.64 lb.). These wheels are similar to those used on the A.N.E.C. monoplanes in the 1923 Lympne contest. The strut arrangement is similar to that employed on torpedo seaplanes, each wheel having two diagonal struts in V formation, extending from joints at the fuselage longerons without a horizontal connecting axle and are free to oscillate laterally. The landing shocks are communicated through a vertical strut to elastic cables situated within the wings instead of to the usual shock absorbing mechanism at the wheels. Whether or not this method may cause a serious strain on the wing structure in the event of a hard landing, resulting possibly in a subsequent failure in flight, is a very important consideration.

The engine is mounted on a steel structure and cowled in with

the finned cylinders projecting sufficiently for air cooling. The cowling is easily removable, giving ready access to both engine and gears. A planetary reduction gear is used.

The fuel tank is installed behind the engine and is sufficiently high to provide a direct gravity feed.

To meet transportation requirements, a special carriage equipped with a pair of rubber-tired wheels is used. The airplane is carried with its wings parallel to the fuselage, the stabilizer being raised to a vertical position and fastened with a tie rod which is hooked into its hinges. The center section is carried on one side and the two end sections on the other.

But few particulars are available regarding the performance of this airplane, but in a solo flight it is said to have reached an altitude of 2134 m (7000 ft.) and to have made a duration flight of 3 hours and a distance flight of 118 miles. With a passenger it is credited with an altitude of 1100 m (3600 ft.), a duration of 2 hours and a distance flight of 75 miles.

Considering the low engine power, these results are very creditable and especially so, since the airplane was designed four years ago, before the efficiency of light airplanes began to be apparent.

Fig. 11 contains the engine data, areas, dimensions and outline drawings.

"Caspar C 17" Monoplane.*

The "Caspar C 17" light airplane (two-seat low-wing monoplane), without external bracing of any kind, was designed by Ernst Ritter von Loessel of the Caspar Works, and contains several unorthodox features.

The specifications which the designer endeavored to meet were: that the power shall be the minimum, approaching as nearly as possible that required for a single seater; that the fuel consumption be kept low so that its cost would not exceed proportionately that of the single-seater; furthermore, that the performance and maneuverability be suitable for school work, sport flying and touring and yet that the construction be cheap, not by using inferior materials but by a simplification, duplication and standardization of parts, otherwise the purpose of the project would be defeated.

The low wing is rather typical of "German" design as also the high aspect ratio, large span and short fuselage, the first feature being chosen, of course, as a matter of efficiency. It was also the intention to make the airplane as easy to fly as possible, and also to insure comparative safety for an indifferent or less efficient pilot. This led to a very novel construction. At the point of attachment of the wings to the fuselage there is a device which permits the wings to adapt themselves to some extent to conditions of flight, caused by gusts, without disturbing the balance of the airplane.

* From "Flight," Nov. 20, 1924; "Deutsche Motor-Zeitschrift," Oct., 1924; "L'Ala d'Italia," Oct., 1924.

As a means for maintaining the trim under all conditions of flight and yet retaining controllability, the designer has incorporated a device which interconnects the elevators and wings, causing them to move in unison. A further consideration of these features, and also to have the airplane as little prone as possible to spinning, led to the choice of the short fuselage and the wing section, Göttingen 348.

As previously referred to, the construction is of interest due to the principle followed in using a series of complete units which are attached to a central framework of steel tubes, forming the backbone of the airplane and serving as a central point of attachment for fuselage, wings, engine unit, landing gear and weight of pilot and passenger.

The fuselage is of rectangular section, and consists of a framework of stringers with a covering of three-ply wood. All stringers and fuselage struts which are arranged to form a triangulated structure are of the same triangular cross-section. At the stern, the fuselage proper terminates in a rectangular frame to which the elevator and rudder are hinged and which also supports the tail skid. The streamlining is continued at this point by the use of a pyramid of duralumin which is also attached to this frame, the elevator being divided with the necessary clearance for proper operation.

There is no fixed stabilizer or fin.

The wing, of high aspect ratio, is supported by two narrow box-section spars, placed relatively close together. The space between

them contains the bracing tubes which run from the lower flange of the front spar to the upper flange of the rear spar, while another series of tubes runs from about the neutral axis of the rear spar to the trailing edge of the wing and still another series from the lower flange of the rear spar to the top flange of the wing rib with a vertical dropped from this point to the bottom rib flange. There are but three different sizes of ribs and the minimum numbers are used to hold down the cost. They are spaced from 0.8 m to 1 m (2.625 to 3.281 ft.) apart. The wing covering is three-ply, attached to the widely-spaced ribs, and is stiffened against local buckling by stringers which run parallel with the spars.

In the device permitting the wings to adapt themselves to flight conditions caused by gusts, the wings oscillate around a pivot situated in a fitting just aft of the front spar, while the torsional deflections are opposed by spiral springs encircling long bolts which extend from top to bottom of spars. These bolts are equipped with wedge-shaped nuts at top and bottom to engage them with the slotted steel plates - a feature in all Caspar airplanes - and is employed for making a quickly-detachable joint where a wing is built in several sections. The addition of the springs is, however, new. In a test the springing wings were found to render the airplane particularly insensible to gusts, steady flight being maintained even in very "bumpy" weather, while the other feature of gaining extra lift from the pulsations was not referred to in the report of the test.

The landing gear as shown in half-tone cuts, seems to be some-

what different from the usual type. Elastic cord shock absorbers are used, however, but seem to be wrapped over the axle and around under a fitting which is attached to the ends of the two struts. The regular type of wheel, consisting of wire spokes covered with canvas in the usual way and with a pneumatic tire, is used and the whole structure seems to be a very sturdy affair.

The engine is mounted on a metal framework and drives a Bork propeller approximately 4 ft. in diameter. It is claimed that the engine has a power output of 30 HP. at 3200 R.P.M., and during a test flight the airplane flew at a constant altitude with the engine delivering 16 HP. and turning at 2200 R.P.M., showing the reserve power to be satisfactory and sufficient for normal flying with engine throttled.

The characteristics are:

Dead load	145 kg	(320 lb.)
Useful "	180 "	(396 ")
Full "	325 "	(716 ")

comparing favorably with that of the "Cygnet" biplane in the Lympne contest.

Take-off	80 m	(87.45 yd.)
Landing speed	55 km/hr.	(34.18 M.P.H.)
Maximum "	115 " "	(71.46 M.P.H.)
Rate of climb	1000 m	(3281 ft.) in 12 minutes
Estimated ceiling	3500 m	(11483 ft.)

Wing loading 20.8 kg/m^2 (4.25 lb./sq.ft.)

Power " 10.8 kg/HP. (23.8 lb./HP.)

Fig. 12 contains the outline drawings, dimensions, areas and engine data.

"Udet" Monoplane.*

The "Udet" light airplane (two-seat low-wing monoplane), another product of the "Udet Flugzeugbau", is intended for training and sport flying.

The wing is in one piece, the spars running through under the fuselage. The spars are of box-section and of ample strength, special attention having been given to the loads encountered in maneuvers and when pulling out of a dive.

The fuselage is of plywood. Two seats are provided in tandem situated very closely together, the pilot occupying the front seat, making communication quite easy.

The engine is carried forward in a structure of steel tubing with a metal fireproof bulkhead separating it from the fuselage.

The proportion of movable control surfaces to fixed surfaces is so chosen that the operation is as light as though rudder and elevator were balanced.

The landing gear is of the orthodox design, with rubber cord shock absorbers. The wheels are provided with standard motorcycle tires, which are readily obtainable.

* Jane's "All the World's Aircraft," 1923.

The characteristivs are:

Dead load 230 kg (507 lb.)

Full " 410 " (904 ")

Wing loading 46.6 kg/m² (9.5 lb./sq.ft.)

Power " 11.7 kg/HP. (25.8 lb./HP.)

Speed 155 km/hr. (96.3 M.P.H.)

Fig. 13 contains the outline drawings, dimensions, areas and engine data.

"KF" Monoplane.*

The Aachen "KF" light airplane (one-seat high-wing monoplane) designed by Kemperer and built by Aachener Segelflugzeugbau Ltd., is a thick-wing monoplane with a central wing length rigidly braced to the fuselage. The outer lengths of the wings are entirely cantilever with a pronounced sweepback of the leading edge at the tips.

The fuselage is of rectangular section with an inverted vee-shaped deck. The cockpit is situated under the wing, at which point the deck is omitted.

The landing gear consists of two streamlined outwardly inclined struts which project from the bottom of the fuselage with the wheels sprung from their ends.

The fin and rudder are unusual in their backwardly inclined position.

The airplane is credited with an initial climb rate of 60 m (200 ft.) per minute, and a maximum speed of 46 M.P.H.

Fig. 14 contains the outline drawings, areas and engine data.

* Jane's "All the Worlds Aircraft," 1924.

LIGHT AIRPLANE OF LITHUANIA

"Dobkevicius" Monoplane.*

The "Dobkevicius" light airplane (one-seat high-wing monoplane), was designed, built and flown by a young Lithuanian engineer at Kaunas. It is somewhat under size but has been found to be very efficient, well proportioned and to have good aerodynamic characteristics.

The fuselage is very deep, narrow and short, but with a good streamline form. It has four longerons of ash and is covered with three-ply wood. The forward portion or engine housing, consists of aluminum sheeting. The deck of the fuselage is well faired, and in cross-section conforms to the shape of the pilot's head and shoulders. The cockpit is situated about one-third of the chord from the trailing edge and, to facilitate a downward view, large transparent panels are set into the wings at their junction with the fuselage.

The controls are quite standard, with no wires or levers exposed to increase structural drag.

The landing gear structure is quite orthodox with the inverted V side struts and rubber cord shock absorbers. Two sizes of wheels are used: the smaller, shown in the outline drawing, for smooth airports; while the larger size is used for cross-country flying.

In landing, with the engine stopped, the airplane loses speed very slowly, which is further evidence of its good aerodynamic

* Jane's "All the World's Aircraft," 1923.

efficiency. The landing speed, however, is said to be very low.

The engine is mounted on two multi-ply wood frames and the lower longerons.

All heavy fittings are located very near the center of gravity.

The gasoline tank is installed on the top of the fuselage directly in front of the pilot, at which point it serves both as a wind shield and as streamlining.

Specifications:

Dead load	167 kg	(368 lb.)
Full "	295 "	(650 ")
Wing loading	39 kg/m^2	(8 lb./ft.^{2})
Power "	8.45 kg/HP.	(18.63 lb./HP.)
Gasoline capacity	60 l.	(15.9 gal.)
Oil "	5 l.	(1.3 ")

The usual line drawings with dimensions, areas, and engine data are given in Fig. 15.

LIGHT AIRPLANE OF ITALY

"Rondine" Monoplane.*

The "Rondine" light airplane (one-seat monoplane), also known as the "Pegna-Bonmartine," a product of the "Construzioni Navali-Aeronautiche," is a strikingly interesting airplane.

According to published information, it made a flight of 30 minutes' duration at an altitude of 300 m (984 ft.) with an A.B.C. 3.5 HP. engine.

Take-off and landing were accomplished on an ordinary highway.

The fineness ratio is 15 and the factor of safety 5. Other characteristics are:

Dead load	130 kg (287 lb.)
*Fuel "	210 " (463 ")
Low speed	35 km/hr. (21.75 M.P.H.)
High "	78 km/hr. (48.47 M.P.H.)
Ceiling	1500 m (4920 ft.)

* With gasoline sufficient for a five-hour flight.

The outline drawings, dimensions, areas and engine data are given in Fig. 16.

The cylinder displacement is 400 cm^3 (24.4 cu.in.), producing 3.5 HP. at 2800 R.P.M. and 5.75 HP. at 3500 R.P.M.

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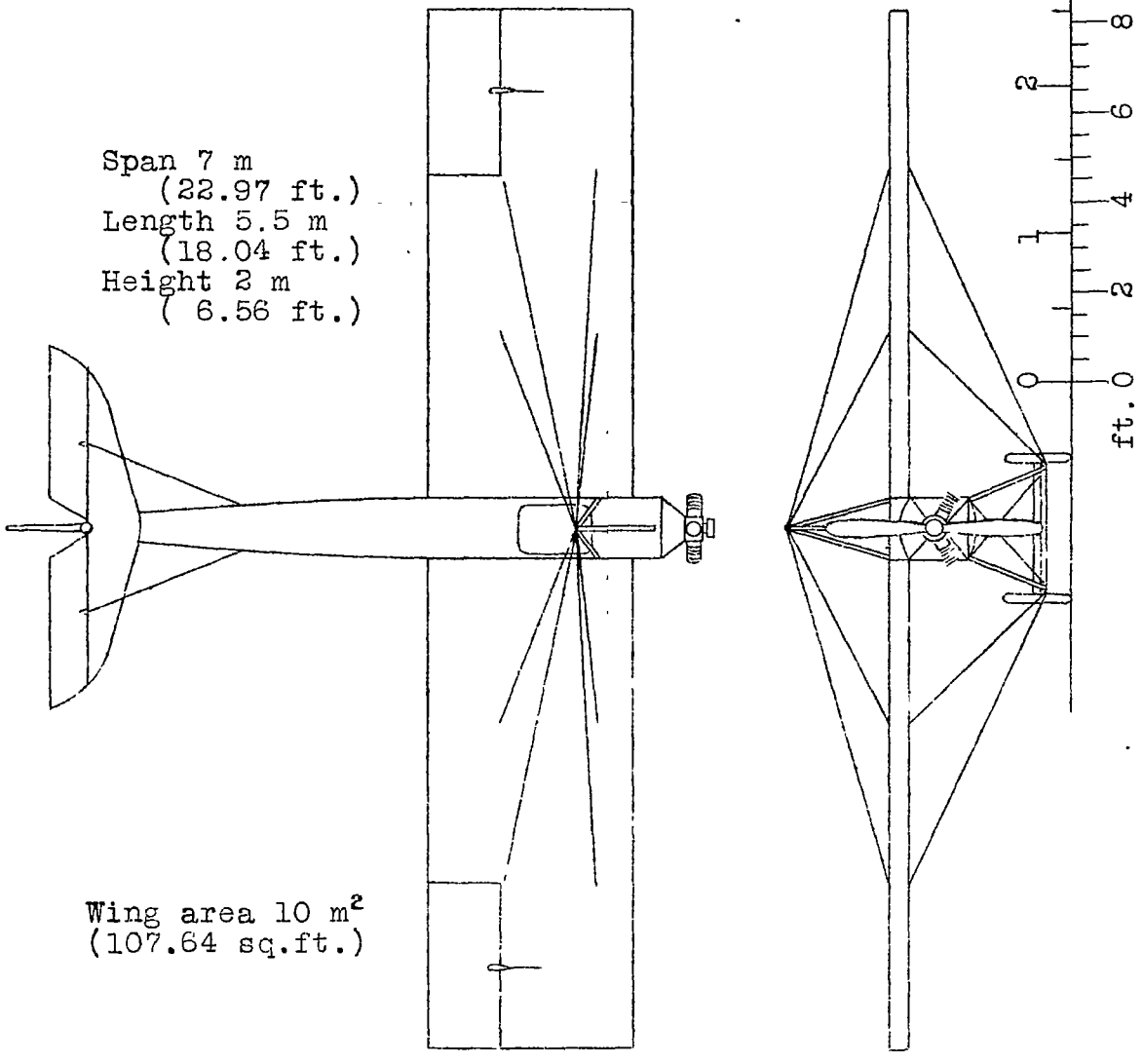
* "L'Aeronautique," July, 1923, and Jane's "All the World's Aircraft," 1923.

The Propeller for Light Airplanes.

In the selection of a propeller, the light airplane designer will find the N.A.C.A. Technical Note No. 212 very useful. Formulae and directions are given in a very practical way, making the determination of diameter, pitch and efficiency a very easy procedure. A complete working drawing can be made with all dimensions - blade width, maximum thickness, angle of attack and location of sections. The maximum thickness occurs at 30% of the chord and all ordinates are obtained by multiplying this thickness by the values given at the individual stations.

In order to follow the directions in this Technical Note, however, the designer must know the normal or brake horsepower (HP.) of the selected engine, and the revolutions per minute (N) at which it is delivered, and also the airspeed in miles per hour (V).



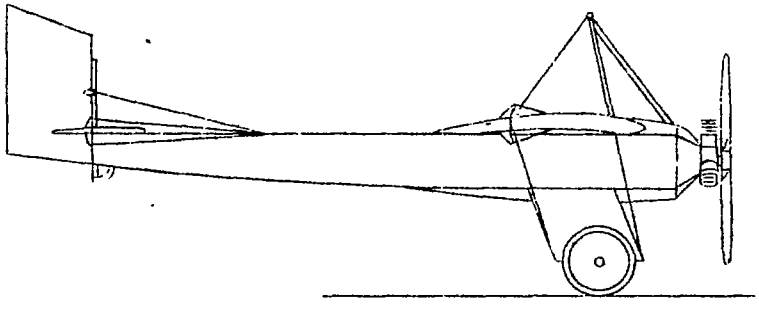


Fig.1 "Farman" one-seat light airplane.

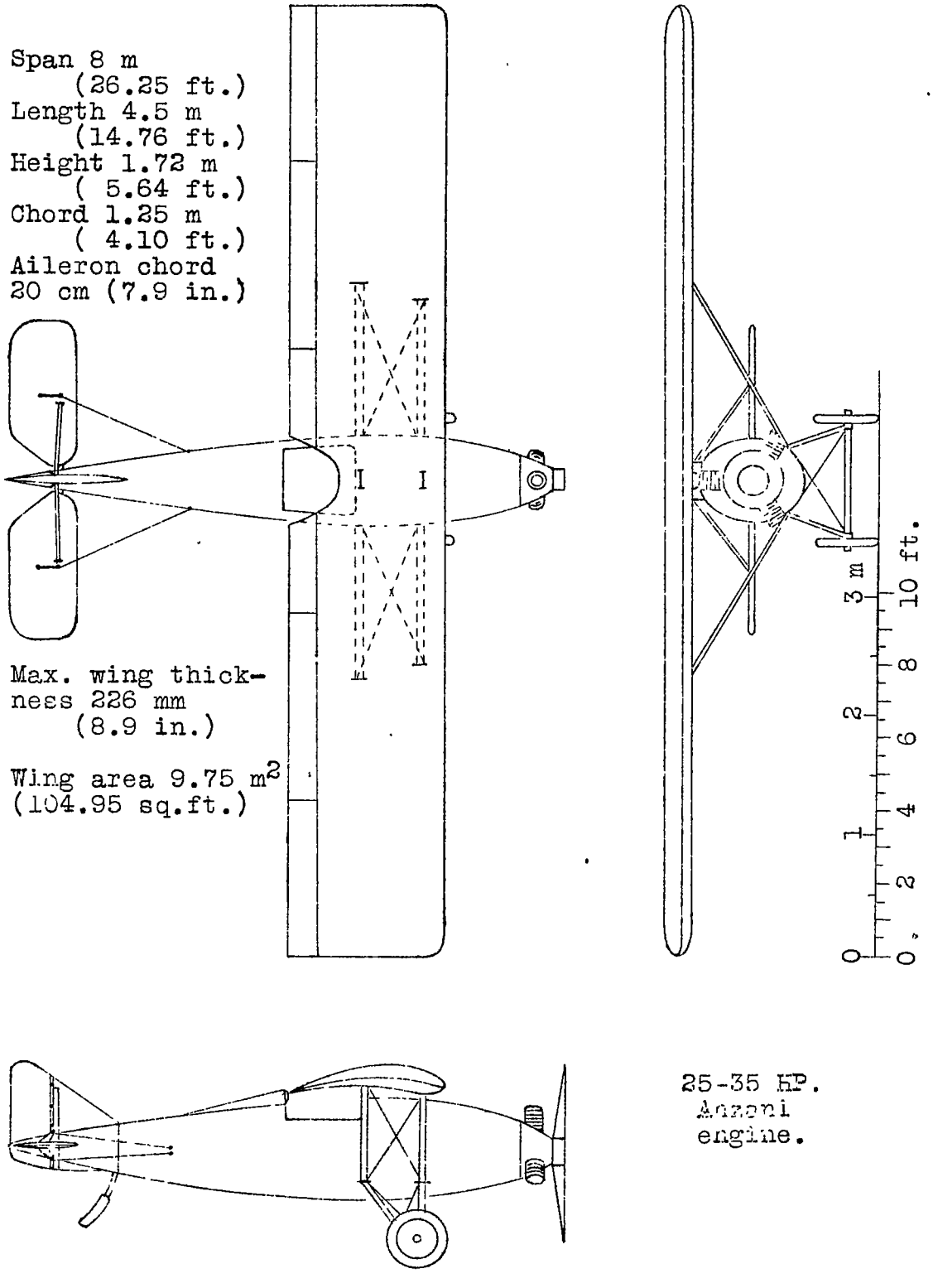
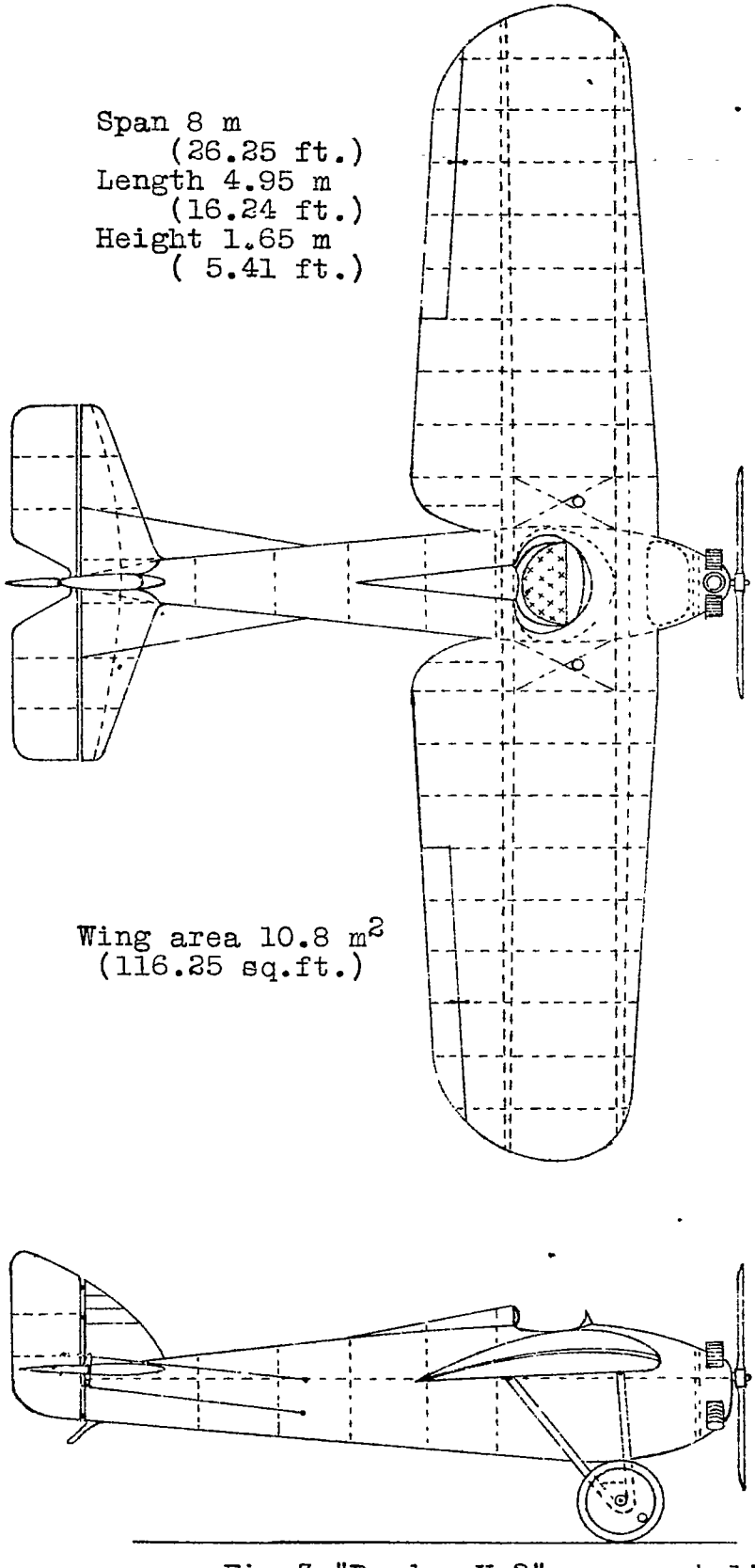
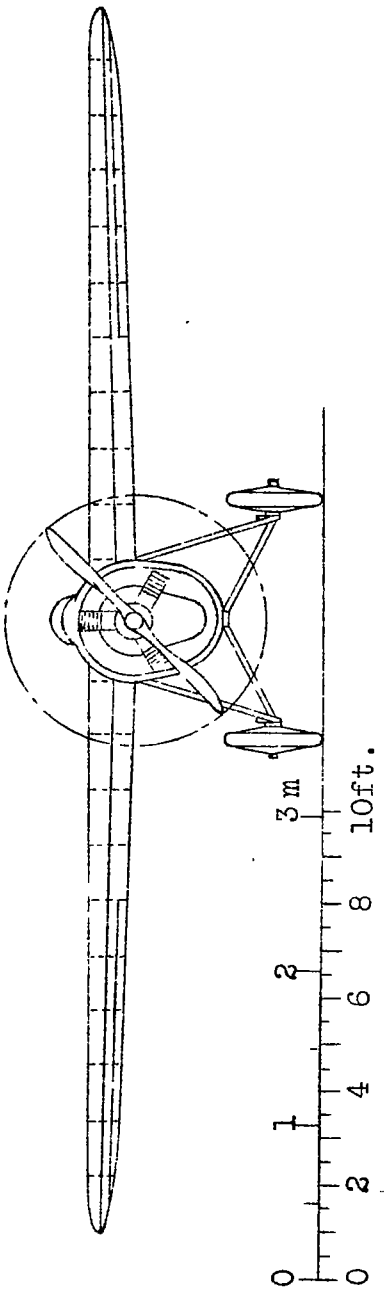


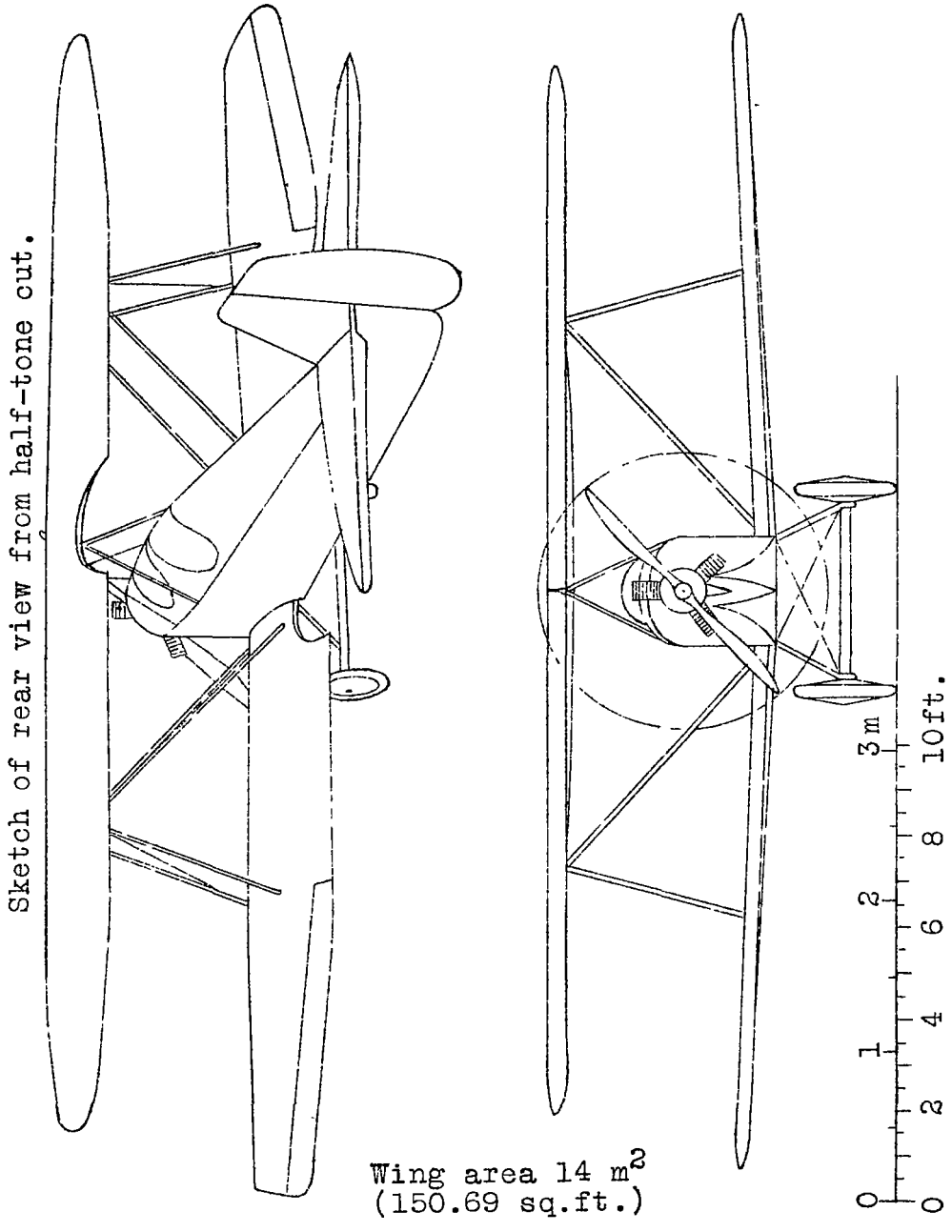
Fig.2 "Carmier" one-seat light airplane.





25 — 35 HP.
Anzani
engine.

Fig.3 "Pander H-2" one-seat light airplane.



Wing area 14 m^2
(150.69 sq.ft.)

Span 7.7 m
(25.26 ft.)

Length 5.68 m
(18.64 ft.)

25-35 HP.
Anzani
engine.

Fig.4 "H-1" two-seat light airplane.

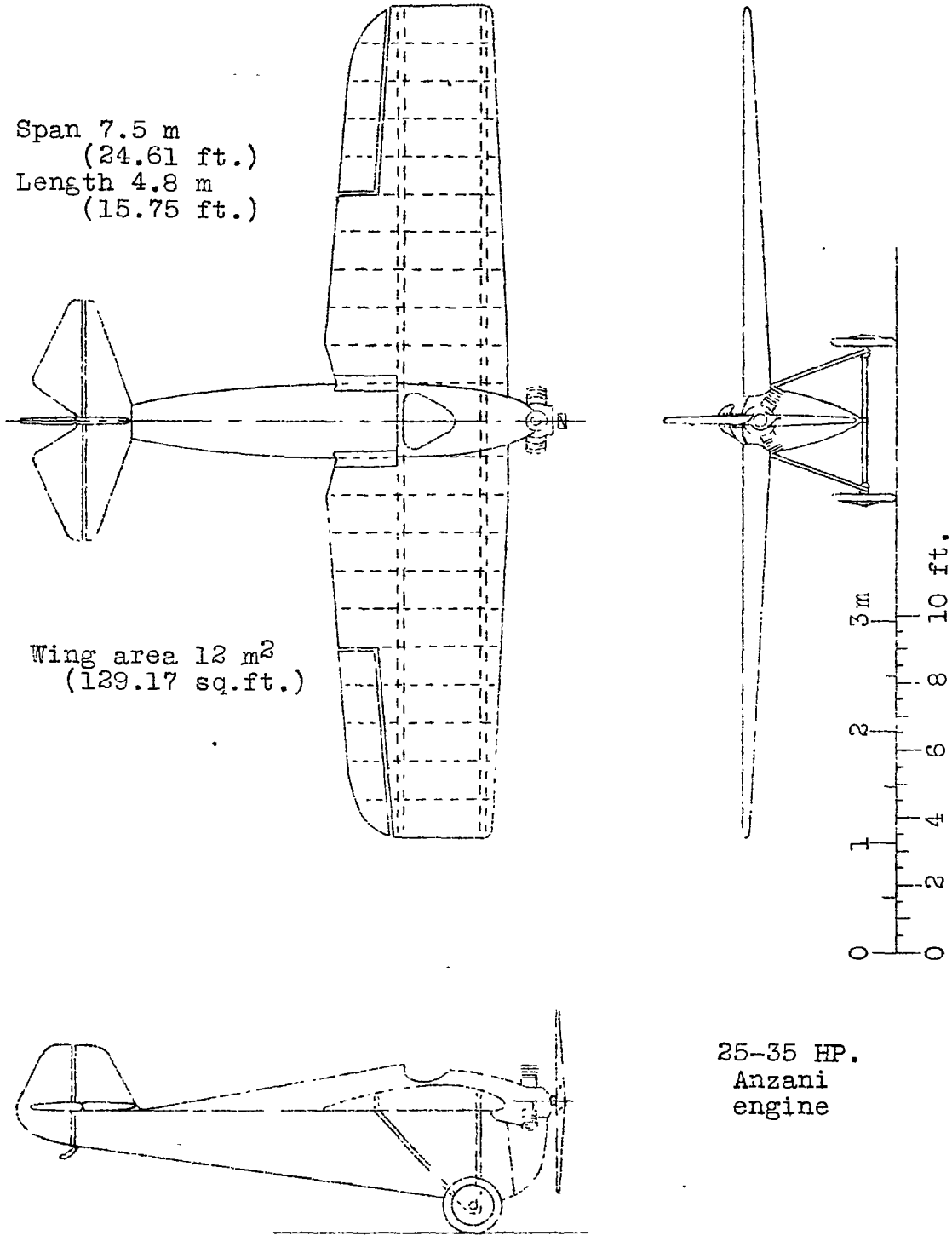


Fig.5 V.S. "12-A" one-seat light airplane.

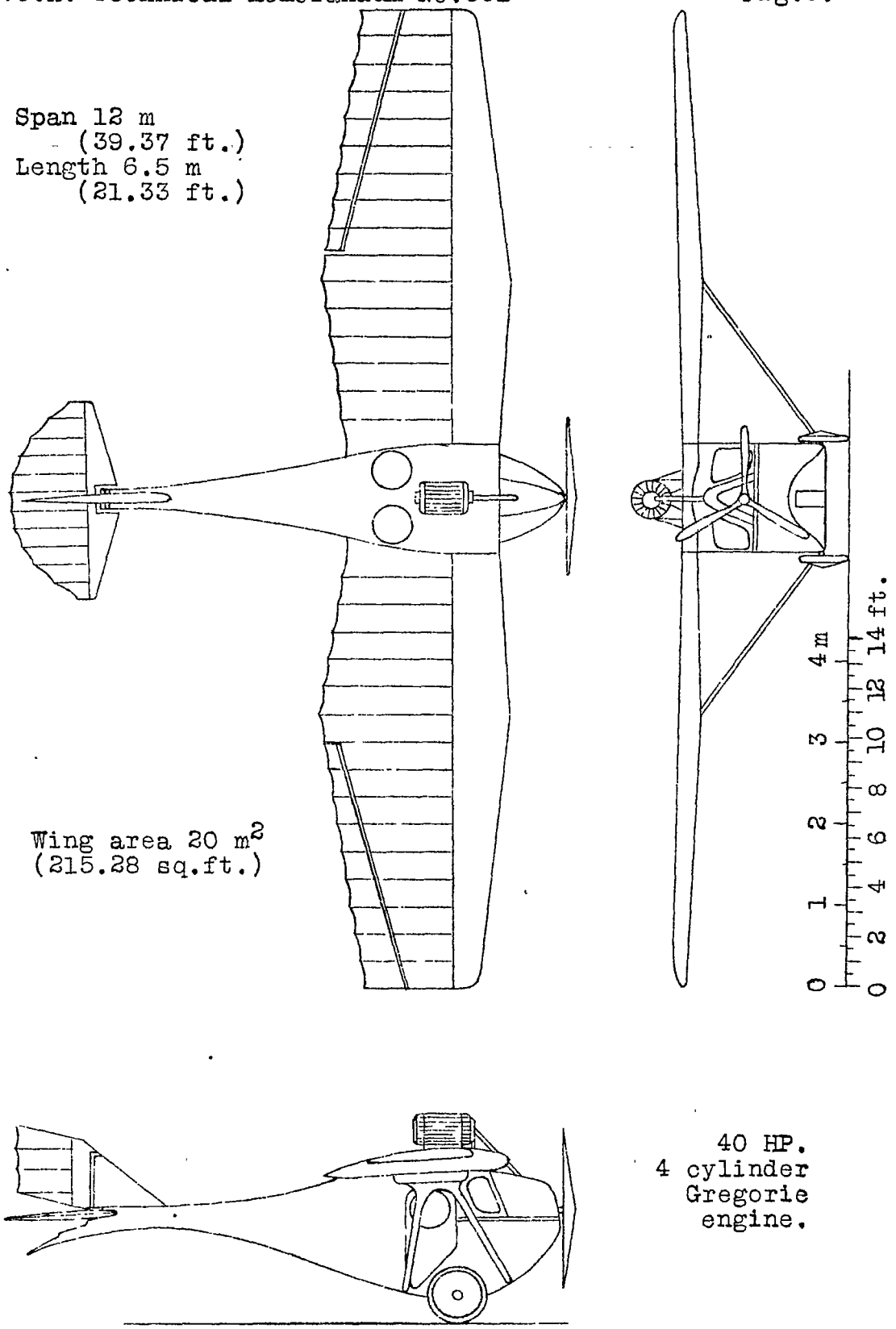
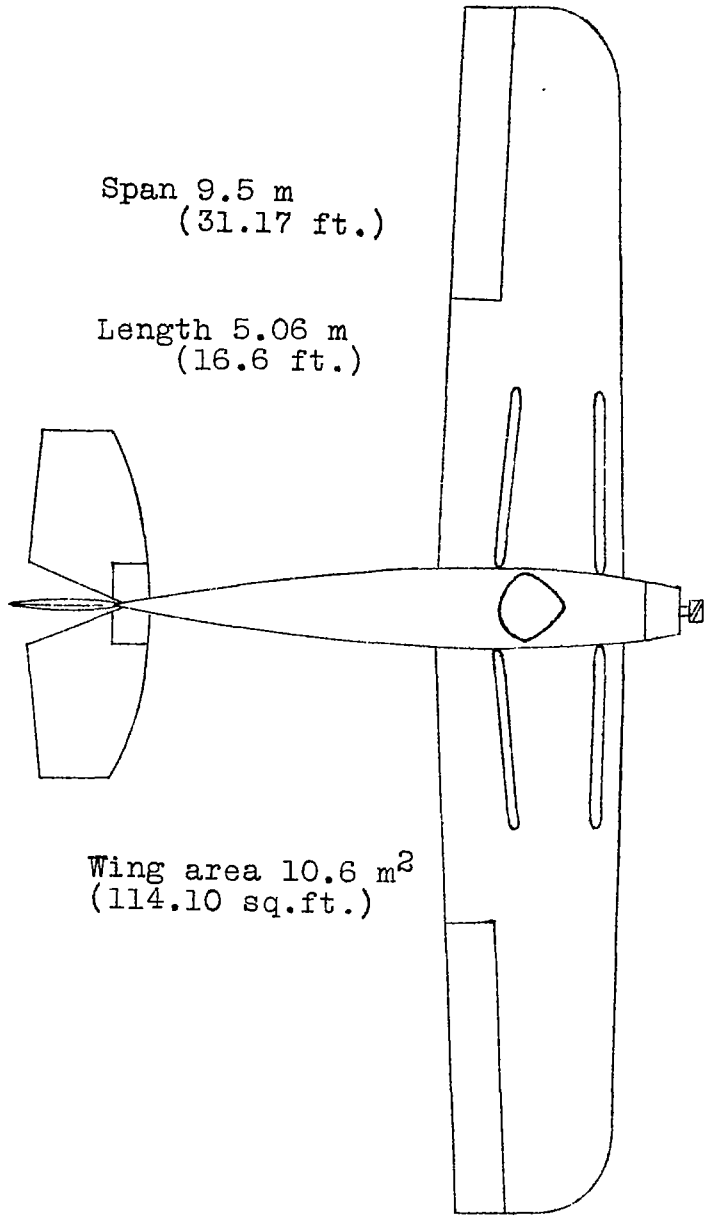
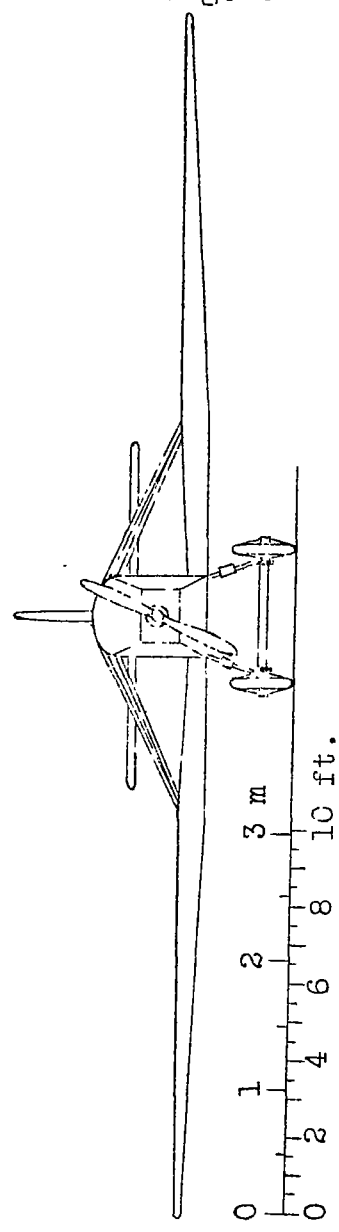
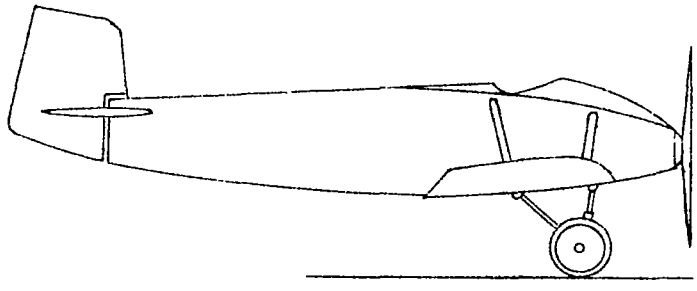


Fig.6 "Demonty-Poncelet" two-seat light airplane.

Fig.7.







Either a 16-30 HP. Vasian or a 16 HP. 2 cylinder Blackburne engine.

Fig.7 "BH-16" one-seat light airplane.

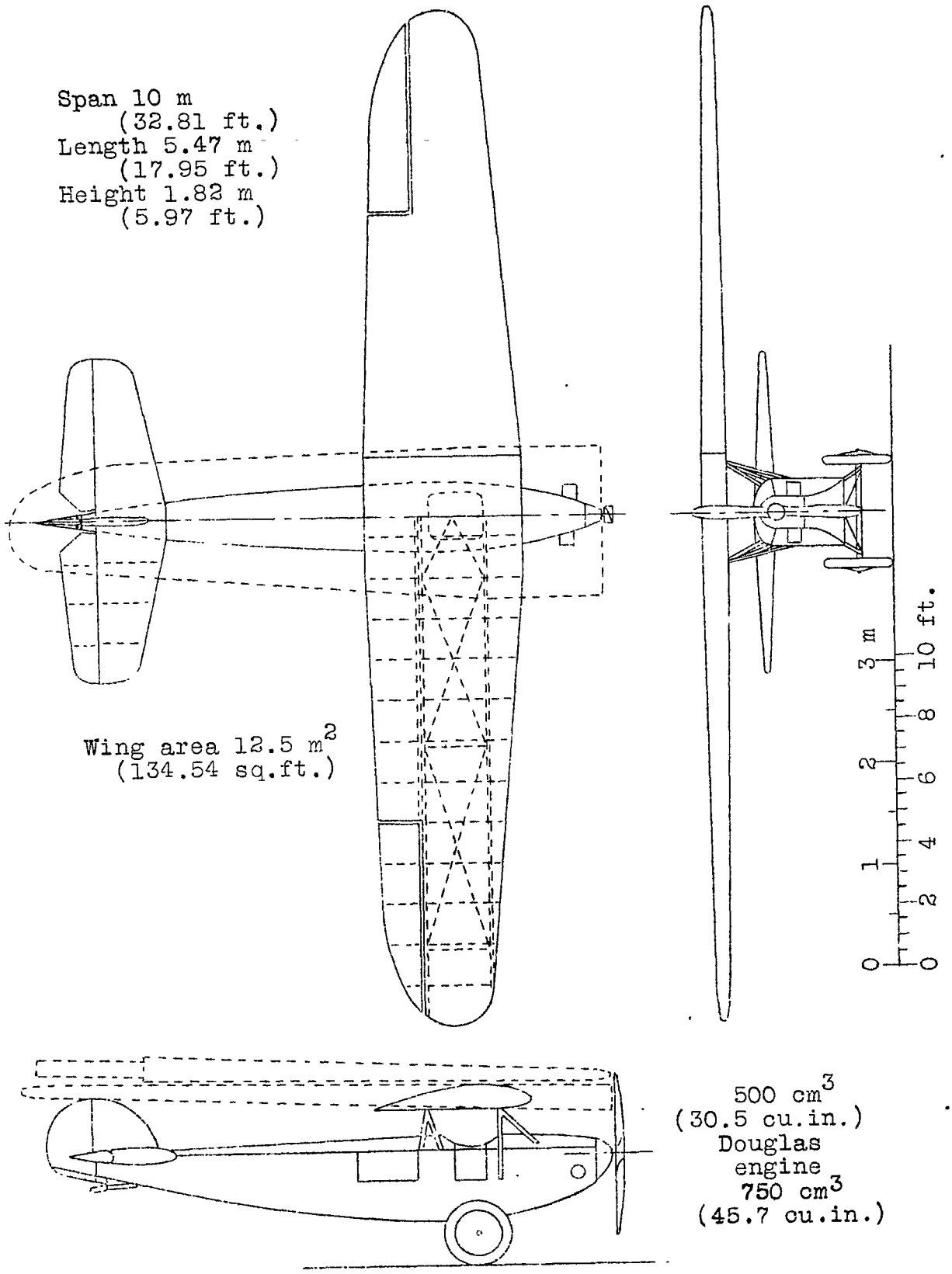
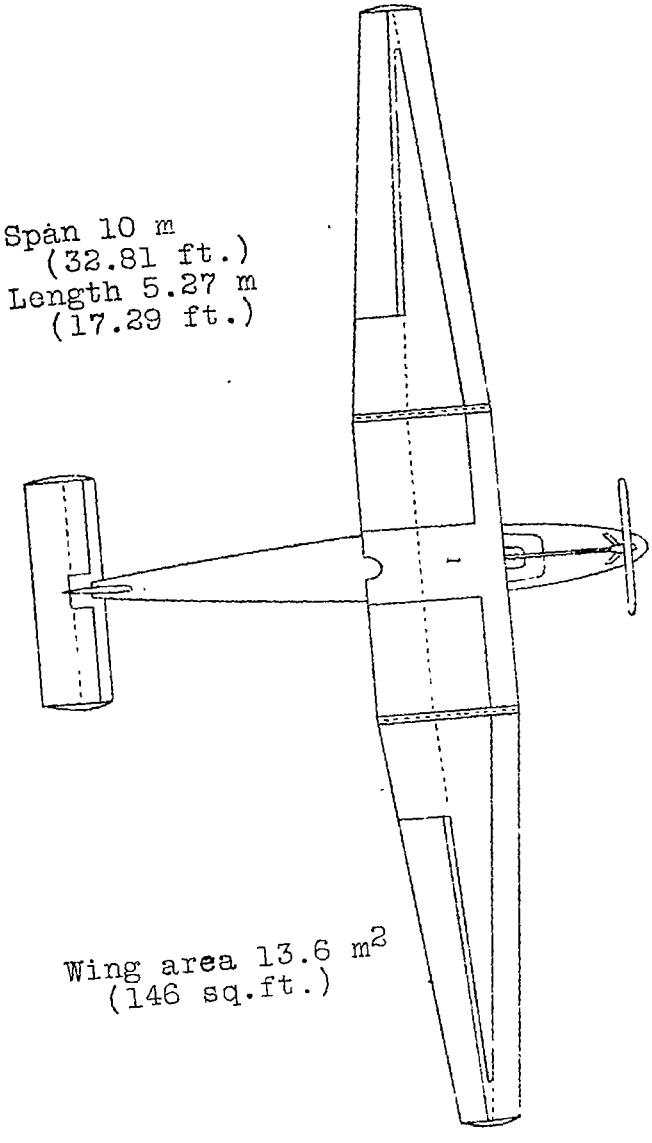
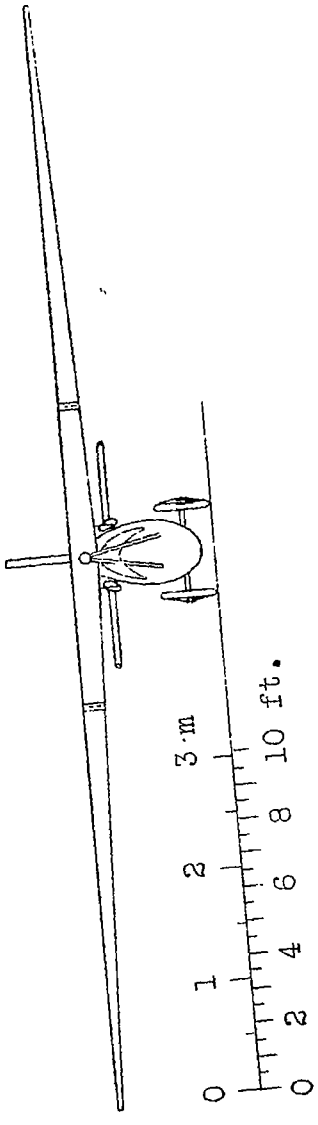
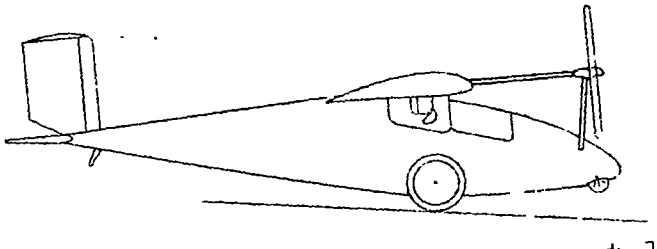


Fig.8 "Kolibri U-7" one-seat light airplane.

Fig. 9



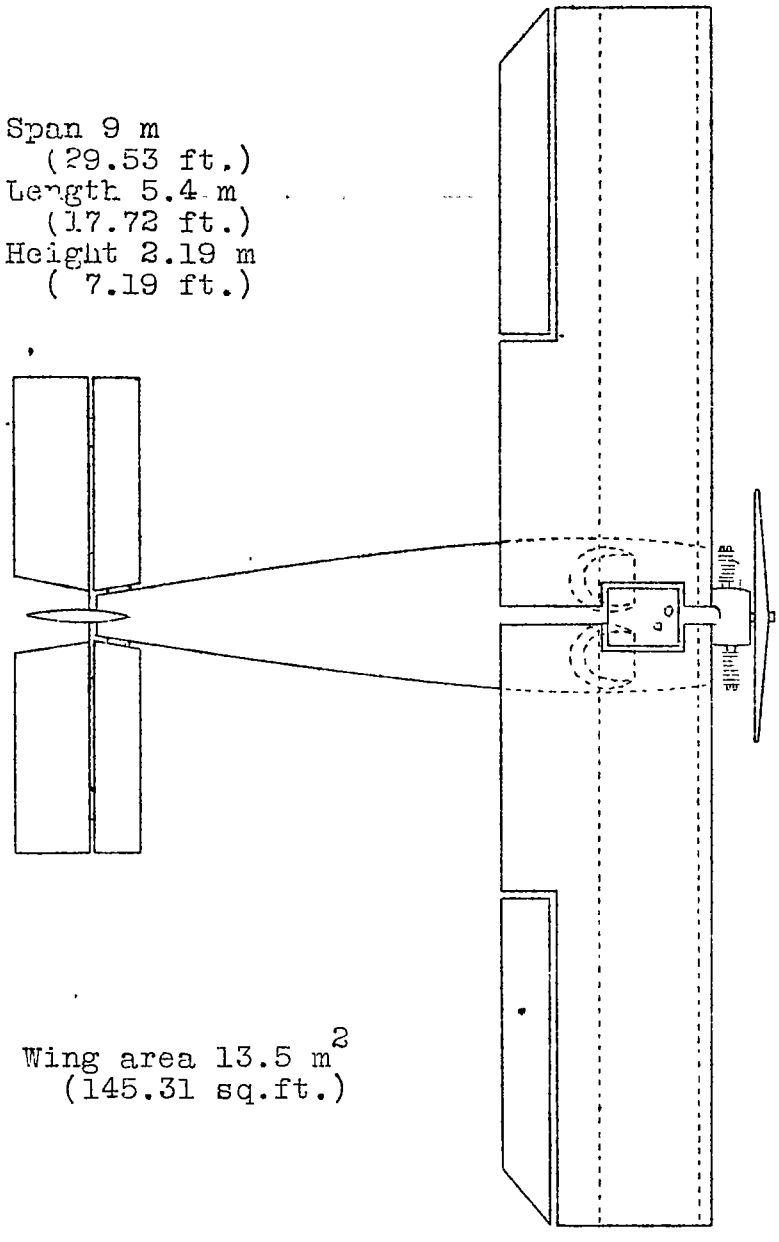




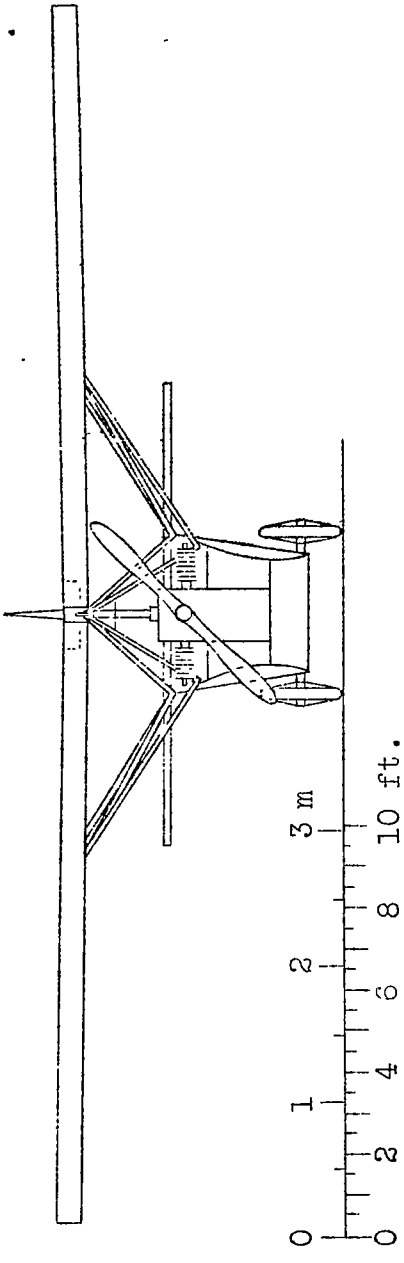
2.75-8 HP.
Douglas
engine

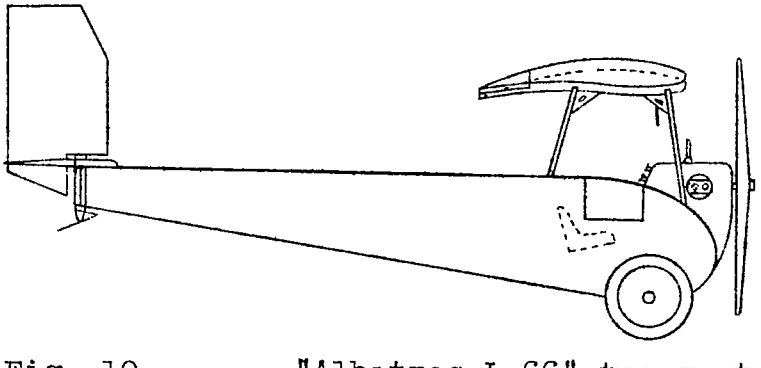
Fig. 9 "Roter vogel" one-seat light airplane

Span 9 m
(29.53 ft.)
Length 5.4 m
(17.72 ft.)
Height 2.19 m
(7.19 ft.)



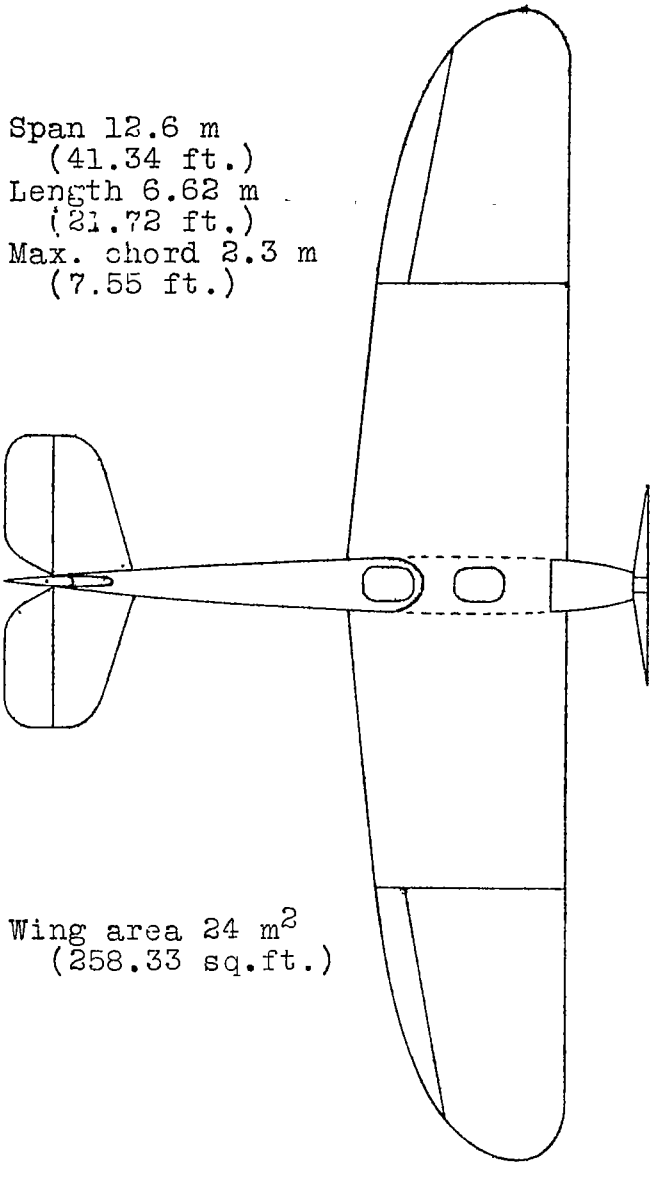
Wing area 13.5 m^2
(145.31 sq.ft.)

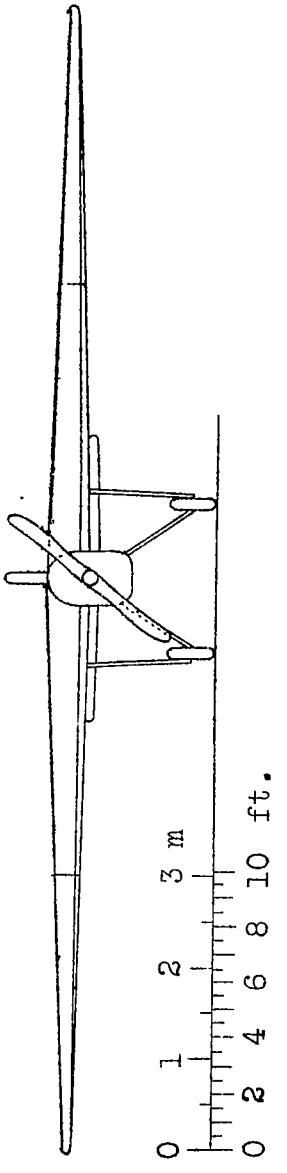


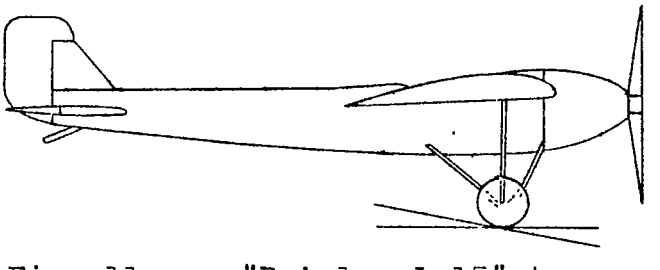


30-40 HP.
engine.
Any engine of suitable dimensions not weighing over 60 kg (132 lb.) is used.

Fig. 10 "Albatros L 66" two-seat light airplane







Special
12 HP.
Fahrrad
motor cycle
engine

Fig. 11 "Daimler L 15" two-seat light airplane

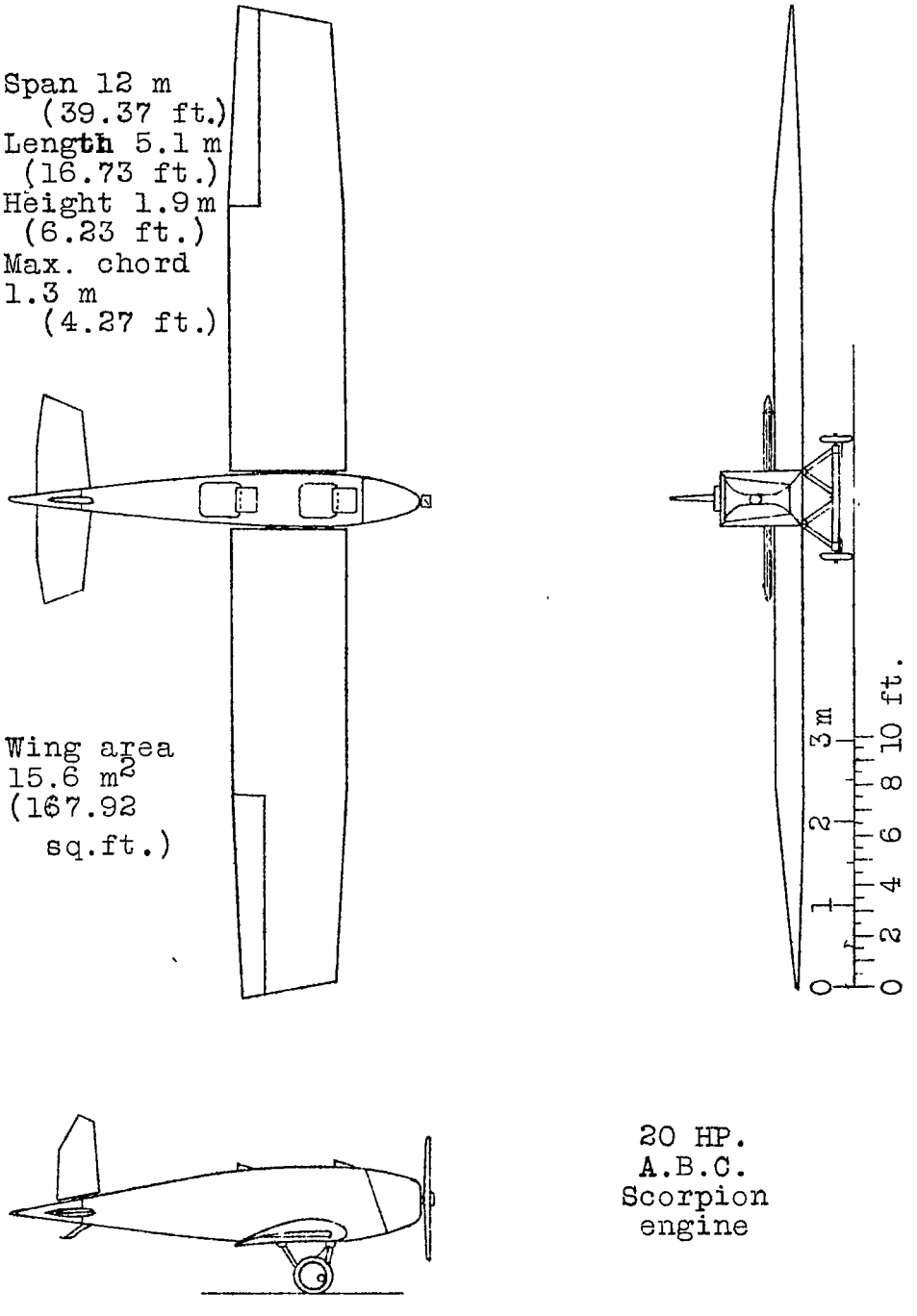


Fig. 12 "Caspar C 17" two-seat light airplane

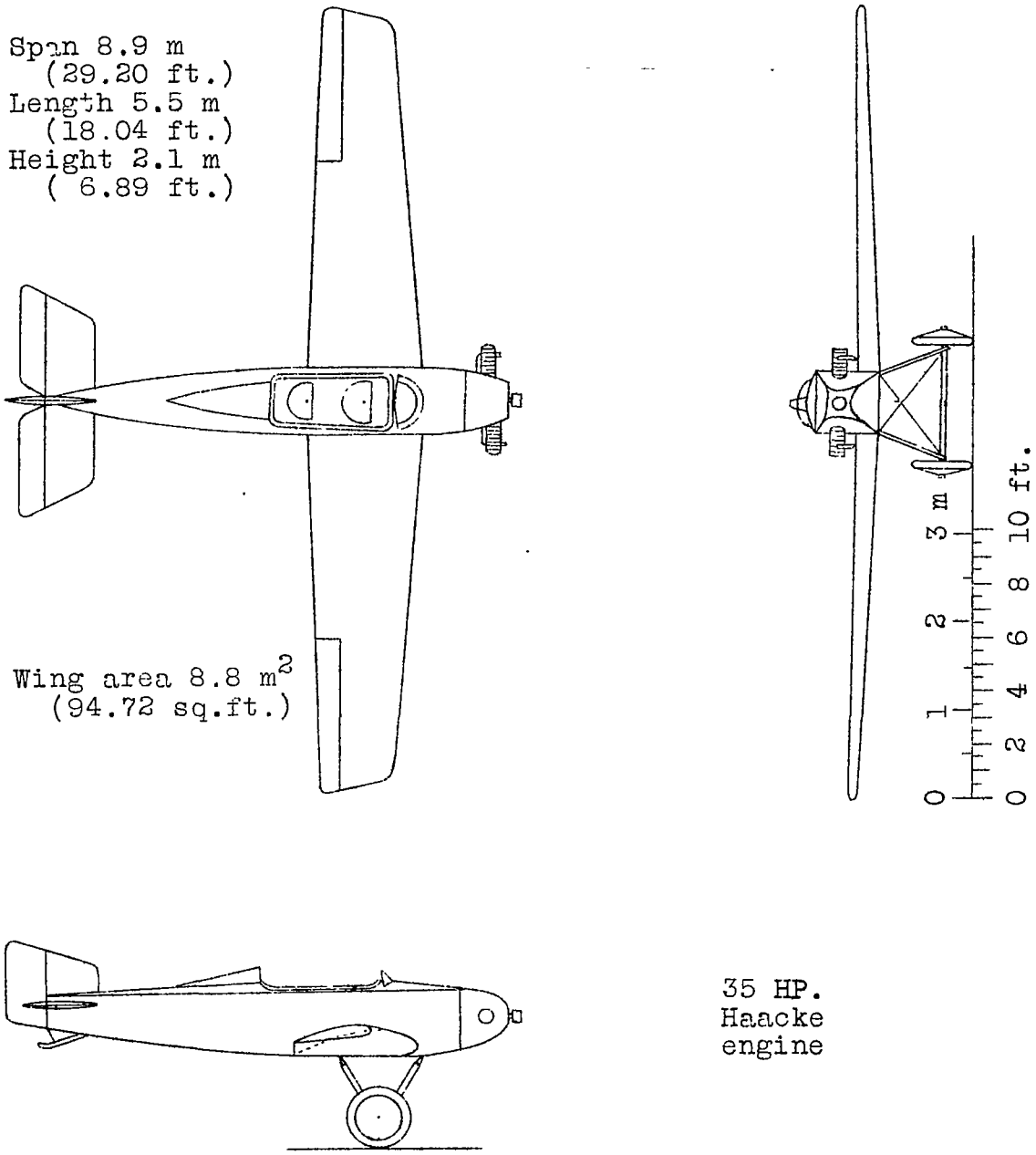


Fig. 13 "Udet" two-seat light airplane

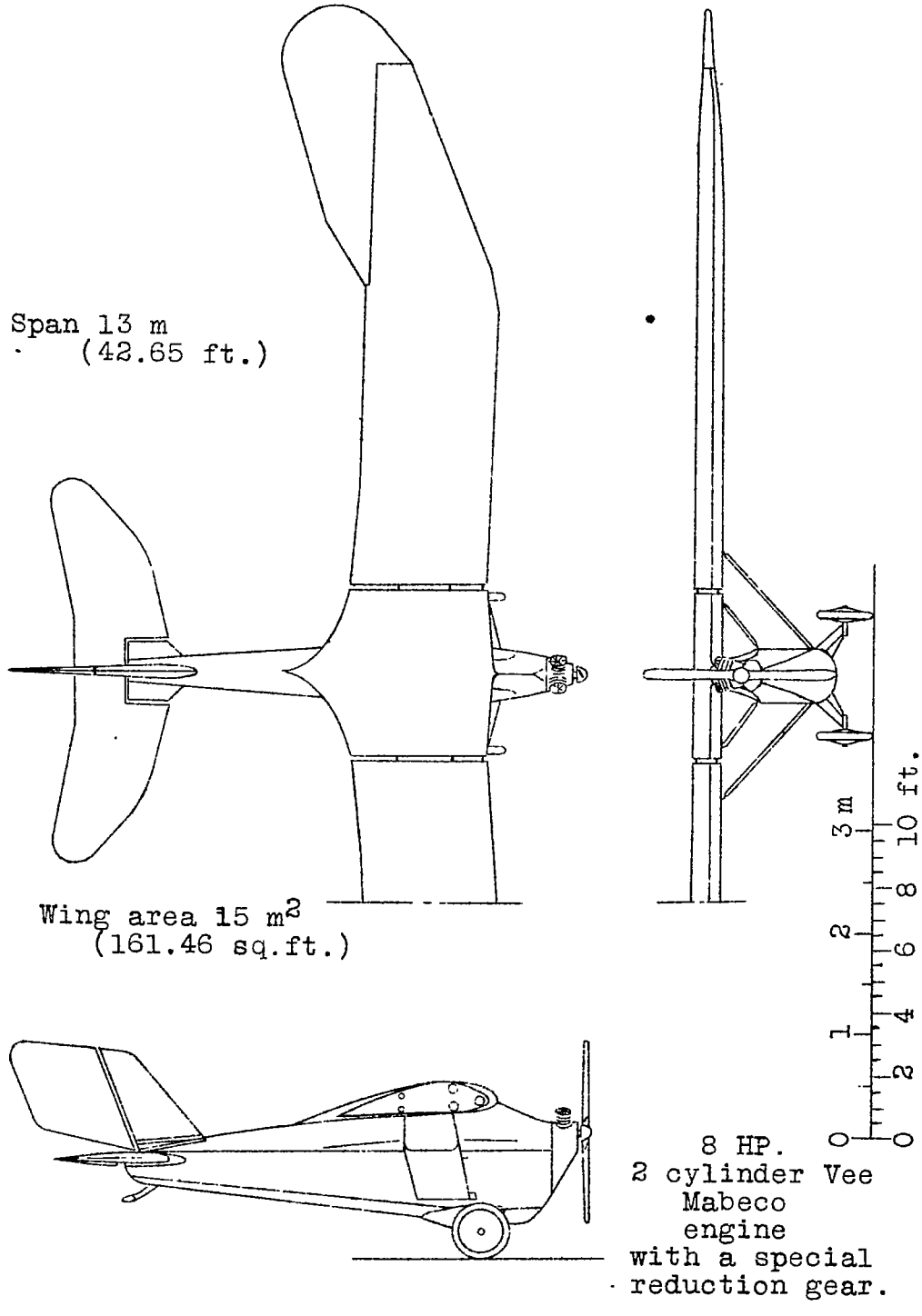


Fig.14 Aachen "KF" one-seat light airplane.

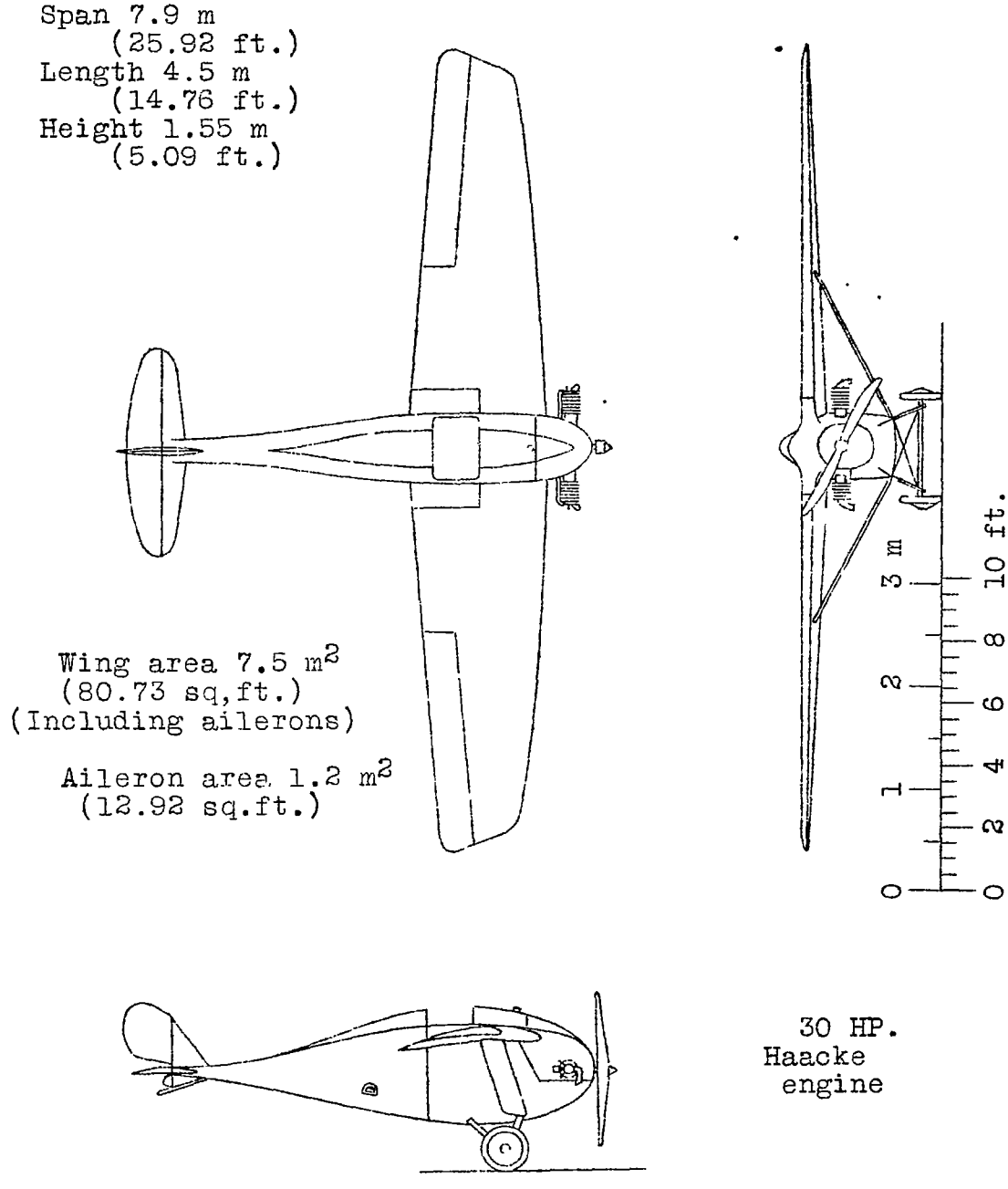


Fig.15 "Dobkevicius" one-seat light airplane.

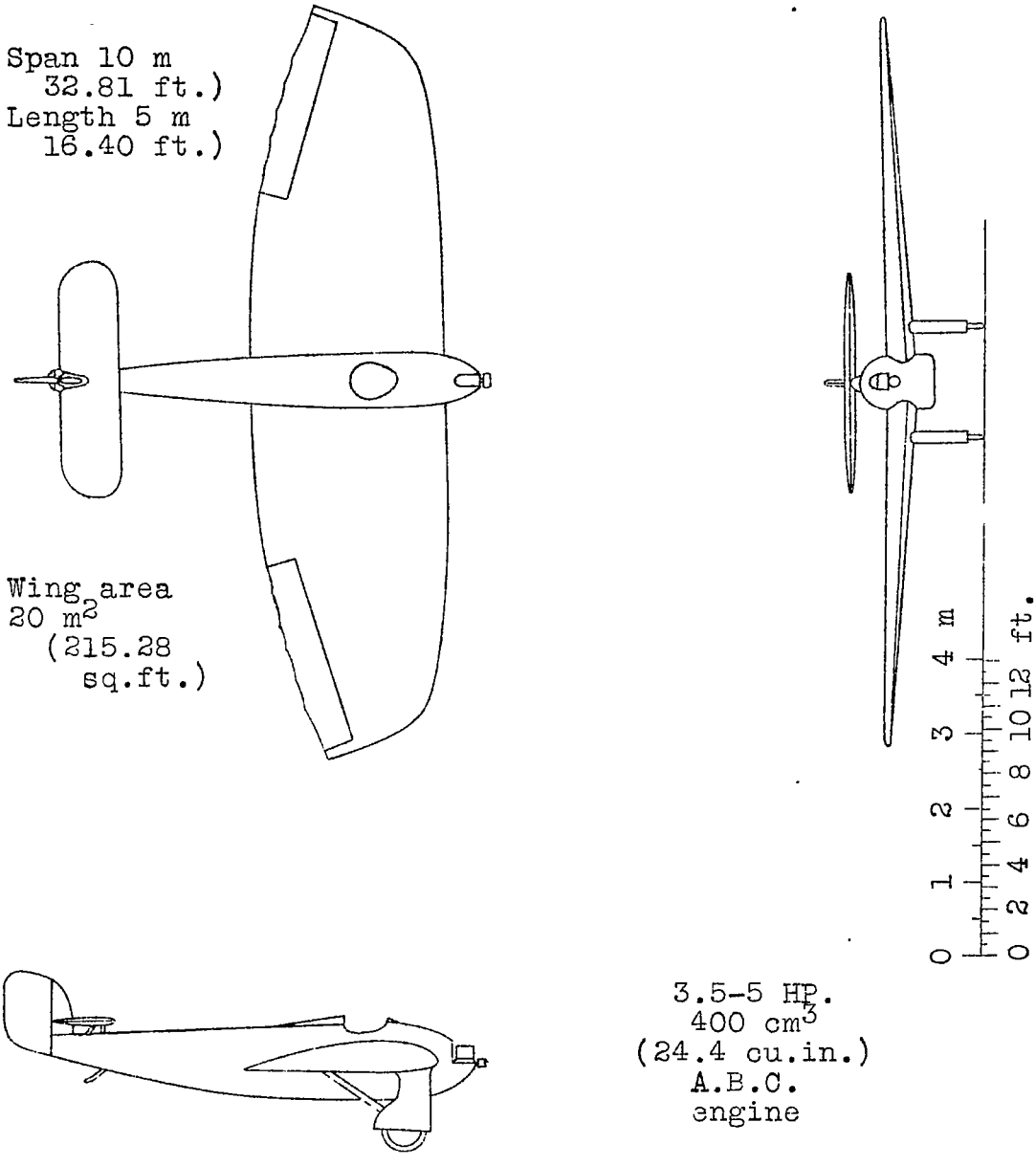


Fig. 16 "Rondine" one-seat light airplane

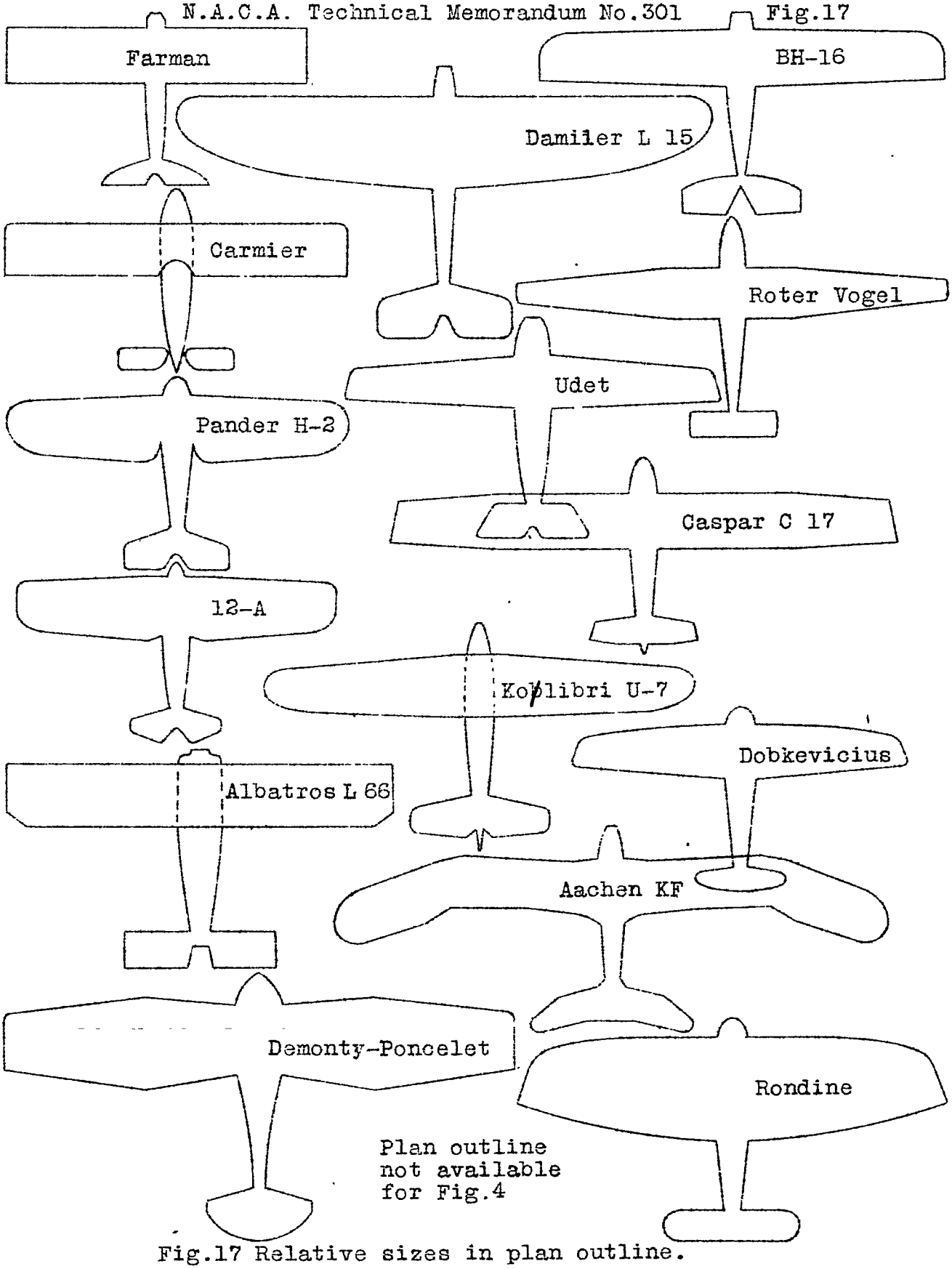


Fig.17 Relative sizes in plan outline.